AN EXPERIMENTAL STUDY OF PROFICIENCY IN SIGHT SINGING A SERIES OF ATONAL INTERVALS WITH ACCOMPANYING SONORITIES

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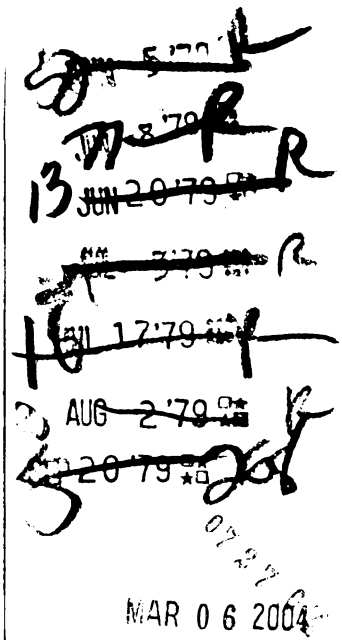
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ABSTRACT

AN EXPERIMENTAL STUDY OF PROFICIENCY IN SIGHT SINGING A SERIES OF ATONAL INTERVALS WITH ACCOMPANYING SONORITIES

By

George Addison West

The investigation of music students' proficiency in sight singing series of atonally arranged intervals (atonal Interval Series) with accompanying atonal sonoroities constituted the main purpose of this study. Increased ability to sight sing unaccompanied tonally arranged intervals through atonal sight singing drill was also investigated as part of this experiment.

Sixty first-year music theory students at the University of Calgary participated in this experiment during the winter term of 1971. The students were enrolled in two class sections which were randomly designated experimental and control groups.

Twenty-four original tape recorded Atonal Sight Singing Drill units were administered to the groups in a language laboratory. The experimental group performed drills comprised of Interval Series with accompanying atonal sonorities sustained by an electric organ. The control

group performed the same Interval Series drills unaccompanied. At the completion of the 24 drills, the remaining 22 experimental and 23 control group subjects experiencing all 24 drills were given Atonal Sight Singing Tests A and B and the Tonal Sight Singing Test (which had also been given as a pre-test).

Atonal Sight Singing Test A corresponded in nature of content and presentation to the experimental group's drills and displayed a reliability of .83. Test B corresponded to the control group's drills showing a reliability of .86. The Tonal Sight Singing Test displayed a reliability of .80 and was similar in content to Test B but with tonal Interval Series. All three tests were originals with internal validity claimed due to the nature of content.

This study was designed to test two primary and two secondary hypotheses related to atonal sight singing performance factors. To succinctly state the primary hypothesis, the experimental group's training experience (accompanied drill) is referred to as Method I; and the control group's training experience (unaccompanied drill) is Method II. All of the hypotheses, tested using analyses of variance and *t* tests, are stated with their results in the following null hypothesis form:

Hypothesis 1

> There is no difference in the ability to sight sing atonal Interval Series between students trained by Method I and Method II. Accepted.

Hypothesis 2

> Progress in ability to sight sing atonal Interval Series based on sight singing drill of atonal Interval Series will not significantly affect progress in ability to sight sing tonal Interval Series. Rejected.

Hypothesis 3

> There is no significant difference between males and females in the ability to sight sing atonal Interval Series. Accepted.

Hypothesis 4

> There is no significant difference between persons with keyboard experience and persons without keyboard experience in the ability to sight sing atonal Interval Series. Accepted.

Although resulting data of this experiment indicated acceptance of Hypothesis 1, the F value yielded (3.02 with df 1/43) by the analysis of variance of Atonal Sight Singing Test B implies that accompanied atonal sight singing drill, though not more effective, is as effective a method of drill as is unaccompanied drill. The rejection of Hypothesis 2 by both the experimental and control groups at the .01 level of confidence decidedly indicates that drill in atonal sight singing will increase the subject's tonal sight singing ability.

The equal ability of males and females to sight sing atonal Interval Series was not surprising, but interaction between subjects with and without keyboard experience within and between groups prevented a more accurate reading of that factor in Hypothesis 4.

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CHAPTER I

THE PROBLEM

Need for Study

Music composed during the final quarter of the nineteenth century displayed a gradual trend away from the established principles of tonality--initially through the increased compositional use of chromaticism and later through incorporations of modal, pentatonic and whole-tone scales. Twentieth century music carried this anti-tonal movement even further through utilization of such structural devices as dual modality, polytonality, pandiatonicism and quartal harmony. Leading into the second quarter of this century the music world witnessed the destruction of tonality with the advent of the tone-row or twelve-tone technique of composition attributed to the genius of Arnold Schoenberg.

Musical composition since then has proceeded in divergent paths, many incorporating in various ways some of the aforementioned techniques. Additional devices (some old--the majority new), considered by some to be bold, bizarre, and revolutionary, have opened new areas of musical exploration.

Now in the eighth decade of this century, at a time when such devices as electronic synthesizers, computers, and

multitrack tape recorders are being incorporated into the art of musical composition, the pedagogical aspects of music theory lag woefully behind. Many of the compositional techniques referred to above are already considered by contemporary composers to be trite and passé. Yet, the basic concern of experimental research in theory pedagogy has been improvement of efficiency in learning the skills of tonal harmonic and melodic techniques.

One of the very few studies concerning atonal (or non-tonal) materials was recently finalized by Sherman and Hill.[1] A succinct statement based on the results of their study advises:

> Theory instructors should come to realize that the musical development of a university student need no longer be retarded because of a rather false and slavish reverence for the past or fear of the present. . . . Music is an ever changing, and today, a rapidly changing art that would most effectively be accompanied by correspondingly changing course of study.[2]

With increased emphasis on the use of tape recordings, teaching machines, and programmed texts during the last two decades, much experimentation has been concerned with the aim of utilizing such teaching aids in certain

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[1]Robert W. Sherman and Robert E. Hill, Jr., Aural and Visual Perception of Melody in Tonal and Atonal Musical Environments, Final Report of Project No. 2413, Office of Education, U.S. Department of Health, Education, and Welfare, Contract No. OE-4-10-177 (Muncie, Indiana: Ball State University, February, 1967).

[2]Ibid., p. 34.

facets of music theory. Several programmed texts have been published in the area of music fundamentals as well as a text by Harder covering the part-writing principles of tonal harmony up through chromaticism.[1] Other programmed texts with accompanying tape recordings of ear-training exercises have also recently been marketed, including a set by Horacek and Lefkoff which also includes some recorded sight singing exercises.[2] All of these aids to effective theory instruction and increased student achievement have evolved through the efforts of experimenters dissatisfied with prevailing practices and limitations. However, the major emphasis of existing programmed materials remains on tonal music skills.

Purpose

Sight singing has only recently been the subject of refined experimental study. The availability and versatility of tape recording techniques has made this possible. There have been less than a score of documented experiments done in the area of sight singing and only one that deals directly with sight singing in an atonally structured music texture. That one study is the investigation of Sherman and Hill.[3]

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[1]Paul O. Harder, Harmonic Materials in Tonal Music (Boston: Allyn and Bacon, Inc., 1968), two volumes.

[2]Leo Horacek and Gerald Lefkoff, Programmed Ear Training (New York: Harcourt, Brace & World, 1970), four volumes.

[3]Sherman and Hill, op. cit.

The lack of research in the area of atonal sight singing, coupled with the interest among musicians related to atonal melodic perception, constitutes the basis for the present study. Of particular interest is whether or not an interaction exists in the performance of an accompanied atonal melody between the performer and the accompanying sonorities[1] as exists in accompanied tonal performance. Edlund seems to indicate that one does not perceive such a relationship when posing the question:

> Does the music so far composed in the 20th century contain any such logical structured principles which could serve as a basis for a method of training the ear? Hitherto the methods have been based on the major/minor tonality with the triad as tonal basis. Is there any other equally clear tonal principle in 20th-century music, and any just as clearly discernible basic tonal design? The answer to this, of course, is "no."[2]

In his reference to "logical structural principles" though, Edlund does allude to other possibilities when describing the presentation order of material in his text.

> The study material presented . . . has been built up on a number of tonal and melodic figures which in the author's opinion have played some part in avoiding the major/minor-tonal limitations in 20th-century music.[3]

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[1]See "sonority" in "Definition of Terms," Chapter I.

[2]Lars Edlund, Modus Novus (Stockholm: Nordiska Musikförlaget, 1963), p. 13.

[3]Ibid.

In opposition to the stand of Edlund on the previously stated subject is that of Thomson[1] who, in the introduction to his recent sight singing text, states,

> One widely maintained (yet surprisingly undeveloped) position maintains that only a reliance on the discrete pitch interval can yield a reading technique that is useful for complex music. The validity of this argument dissolves as soon as its ramifications are made clear. Its most significant implication is that intervals can be apprehended and conceived as absolutes, exclusive of any background context. . . . But attempting to imagine the two pitches of an interval exclusive of any context beyond themselves is like trying to imagine two points in vision without a spatial reference. Rigorous attempts at either seem equally fruitless; both must occupy positions in some form of auditory or visual background of space-time.[2]

This study does not attempt to investigate the possible predictive nature of accompanying atonal sonorities such that exists in tonal harmony. Instead, this study is designed to examine by comparison the affective nature of atonal accompaniment to performed atonal music.

Hypotheses

The hypotheses formulated for this study relate to the main topic of interest previously presented and areas of related secondary interest. These subjects of investigation stated as null hypotheses in general terms are:

1. No significant improvement in atonal sight singing ability will result from atonally accompanied drill

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[1]William Thomson, Advanced Music Reading (Belmont, California: Wadsworth Publishing Co., 1969).

[2]Ibid., pp. ix-x.

in atonal sight singing compared with unaccompanied atonal sight singing drill.

2. Progress in atonal sight singing ability, based on atonal sight singing drill, will not significantly affect progress in tonal sight singing ability.
3. There is no difference between males and females in the ability to sight sing atonal music.
4. There is no difference between persons with keyboard experience and persons without keyboard experience in the ability to sight sing atonal music.

Definition of Terms

1. Atonal--although this term is often ambiguously used, for purposes of this study, the term refers to combinations of musical pitches lacking a devinite relationship to a tonal center that are not triadic or tertian in nature.

2. Atonal Sight Singing Test--a test comprised of Interval Series of five tones each, arranged in such a fashion as to not imply a definite tonal center.

3. Atonal Sight Singing Drills--drills comprised of Interval Series of five tones each, arranged in such a fashion as to not imply a definite tonal center.

4. Hanson's "six basic tonal series"--a "shorthand" method for visual recognition of the intervallic content of any given vertical pitch structure.[1]

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[1]Howard Hanson, Harmonic Materials of Modern Music (New York: Appleton-Century-Crofts, Inc., 1960), pp. 7-16.

5. Interval Series--a series of intervals with no definite rhythmic notation--in the case of this study a series of five whole-notes.

6. Sonority--a term substituted for "chord," since the latter term implies a vertical structure of tonal harmonic usage.

7. Tonal Sight Singing Drills--drills comprised of Interval Series of five tones each, arranged in such a fashion as to imply a definite tonal center.

8. Tonal Sight Singing Test--a test comprised of Interval Series of five tones each, arranged in such a fashion as to imply a tonal center.

Limitations

Sixty students, enrolled in two laboratory sections of first-year music theory at The University of Calgary, were the participants in this study. One section was randomly selected as the experimental group and the remaining section designated as the control group. The duration of the experimental period was approximately thirteen weeks, equivalent to the winter term of study. Atonal Sight Singing Drills, given in a language laboratory, were conducted twice each week over a twelve-week period with drill sessions approximately 22 minutes in length.

At the conclusion of the twelve-week drill period an original two-part Atonal Sight Singing Test was individually administered to all subjects. As a secondary study,

a Tonal Sight Singing Test, which had been given to both groups as a pre-test prior to the twelve-week drill period, was readministered as a post-test. Scores from these tests were compared to measure relative group abilities to sight sing atonally-arranged and tonally-arranged Interval Series.

Overview

The following chapters present the main body of this study and conclusions drawn from its statistical results. A review of related literature, particularly of studies done in the area of sight singing during the last two decades and pertinent to this investigation, is presented in Chapter II. The design of this study with formal statements of the hypotheses to be tested and their analyses appear in Chapter III with the complete analysis, statistical documentation and interpretation in Chapter IV. The summation with conclusions drawn from the statistics and their implications for use by other experimenters in future studies are stated in Chapter V with the appendices following.

For better comprehension of the purpose of this study one must be familiar with earlier investigations in the area of sight singing. Such information will enable one to grasp the logical manner in which it leads to the main hypotheses stated at the conclusion of Chapter III.

CHAPTER II

REVIEW OF THE LITERATURE

One would expect that a disciplined skill dating back at least as far as the known history of music would be the subject of much experimental study. Yet the skill of sight singing, acknowledged by most musicians as a fundamental tool, is one of the least researched areas in music. Furthermore, the application of sight singing to atonal music practices is relatively unexplored. The previously cited study of Sherman and Hill[1] constitutes the only documented information about sight singing in an atonal context, it being just one of fourteen areas covered by their experimentation. It follows, then, that the review of available existing literature must relate to the general area of sight singing, plus studies of perceptual abilities relevant to the experimental design of this study.

In considering the historical development aspect of sight singing, much time could be spent commencing with the contributions of Guido d'Arezzo and tracing a forward progress to the present. However, this has already been done in

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[1]Sherman and Hill, op. cit.

an extremely thorough manner by Ottman[1] in a comparable section of his dissertation. Therefore, repetition of that same anthological account seems unnecessary, and that excellent source is recommended to the reader.

Recent research in sight singing seems to fall into three general areas of emphasis: (1) the development of sight singing tests, (2) factors that correlate with sight singing ability, and (3) the effectiveness of various kinds of drill as teaching devices for improved ability to sight sing. The last area also includes studies on the use of programmed learning materials, teaching machines and tape recorded exercises.

The Development of Sight Singing Tests

The eternal dilemma concerning effective evaluation of sight singing performance has been, and remains, of constant concern to theory instructors. Some of the earliest research aimed toward arriving at satisfactory methods of measurement was done by Hillbrand[2] and Mosher[3] during the

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[1]Robert W. Ottman, "A Statistical Investigation of the Influence of Selected Factors on the Skill of Sight-Singing" (unpublished Ph.D. dissertation, North Texas State College, 1956), pp. 3-37.

[2]Earl K. Hillbrand, Measuring Ability in Sight Singing (Ann Arbor, Michigan: Edwards Brothers Pub., 1924).

[3]Raymond M. Mosher, A Study of the Group Method of Measurement of Sight Singing (New York: Teachers College, Columbia University, Contributions to Education, No. 194, 1925).

mid-twenties of this century. It was not until very recently that this problem was again taken up as a subject of documented research. There have been, of course, many concerned educators who have drawn certain conclusions about this and other areas of sight singing through observation of their students; but this type of conclusion is generally considered to be quite suspect statistically. Reference is made to some of these observations made by respected theorists later in this chapter.

Nelson[1] compared the utilization of a sight singing test incorporating objective short items with the traditional long-item test. Both groups of subjects tested received the same training in sight singing. This study revealed that, for the sample populations tested, the short-item method produced a significantly better evaluation of sight singing achievement than did the traditional long-item approach. In addition to this, three advantages of the short-item test over the long-item test were observed: (1) it contained a wider variety of performance problems with special reference to rhythm, (2) it was found more valid relating to a higher correlation with the dictation test which was also administered to both subject groups, and (3) it displayed greater efficiency in that administration and evaluation of the short-item test took one-third as much

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[1]John C. Nelson, "A Comparison of Two Methods of Measuring Achievement in Sight Singing" (unpublished Ph.D. dissertation, The University of Iowa, 1970).

time as did the long-item approach. Relative to the second advantage, the reliabilities of the sight singing test and the dictation test, computed in four ways, were found to be quite comparable with an approximate average of .95 for each test. However, such comparisons of two different types of tests is questionable.

A performance test to evaluate the effectiveness of Kanable's "A Program for Self-Instruction in Sight Singing" was devised by Smith[1] employing four matched groups of first-year theory students. No significant difference was statistically evident between any of the four groups--only one of which had experienced Kanable's programmed approach--including the group that had received no sight singing training at all. Closer inspection of the results reveals certain areas of possible contaminating factors. The author himself questions the method of evaluation used which included a panel of judges observing live performances. Even so, the results obtained do not discredit the concept of using Kanable's self-instruction sight singing method as an effective substitute for classroom training by an instructor.

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[1]James C. Smith, Jr., "A Performance Test of Kanable's 'A Program for Self-Instruction in Sight Singing'" (unpublished Ph.D. dissertation, The Florida State University, 1968).

The Study of Factors Correlated with Sight Singing Ability

Sight singing requires a synthesis of various musical performance factors which, when equally present, produce accurate musical interpretations. Researchers have approached investigations of these factors in various ways. Some experimenters chose to devise a criterion test which would include all factors and investigate their influence through performance comparison between standard test scores and criterion scores. Other studies have been accomplished through isolation of one or two factors and comparing them with other factors used as experimental variables. The former approach quite often produces interaction between factors causing confusion in interpretation of results. The latter approach receives criticism for placing musical factors in an unmusical form.

Statements by eminent persons connected with the field of music theory have, from time to time, been pronounced in relation to factors influencing an individual's aural and visual musical perception. Often these statements are products of personal theory or founded upon observations of others such as students in classes dealing with ear training or sight singing. Although not based on statistical data, these statements are deemed valuable from the standpoint of reflecting personal experience.

Wedge, for example, states,

> In sight singing there is no need of thinking the interval name or the size of the skip as long as the key is known. It is only when this feeling of key has been broken down by musical skips or a modulation that a knowledge of how to sing absolute or unrelated intervals is needed, and then only until the tonality has been reestablished.[1]

This statement has direct connotations toward the problem of sight singing atonal music. It implies that interval accuracy is of greater importance in sight singing atonal music; but of how great an importance is left open to conjecture or research.

McNaught, referring to the perception of the interval itself, has said, "unless he possesses unusual capacity, [the student] finds himself continually distracted by . . . changes effected on intervals by the tonal relations of the notes."[2] Farnsworth underscores this by commenting that "the interval as an abstraction or in isolation has only slight musical significance. What is of real importance is the interval in some specific context."[3] Still another reference to the relative importance of interval recognition is that of Thomson[4] previously cited in the opening chapter (page 5) of this dissertation.

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[1]George A. Wedge, Advanced Ear Training and Sight Singing (New York: G. Schirmer, Inc., 1922), p. 9.

[2]W. G. McNaught, "The Psychology of Sightsinging," Proceedings of the Musical Association, XXVI (1900), 35-55.

[3]Paul R. Farnsworth, The Social Psychology of Music (Ames, Iowa: The Iowa State University Press, 1969), p. 45.

[4]Thomson, op. cit.

In the broader sense of music perception, Hindemith has written the following commentary:

> One group catches primarily the general impression of a musical structure, and through further analytical thinking--with the aid of repeated apperceptions of the same material or of conclusions based on memory and logic--discovers and adds the constituent parts, thus literally filling out the pre-established musical form.
>
> Of no less importance is the other method, which adds up great numbers of single aural impressions, till in the listener's mind the complete form is synthetically reconstructed.
>
> A well experienced musician will never rely on either of these two methods alone but will always mix them, using at any given moment (consciously or intuitively) the one that gives him the greater push forward.[1]

Early studies by Salisbury and Smith[2] and Dean[3] tried to determine what factors were correlated with sight singing ability. Salisbury and Smith found the main evaluating factors to be dictation, pitch and tonal memory; whereas Dean, through determining the value of using the Seashore Measures of Musical Talent in the prediction of success in sight singing, found the Seashore pitch test and Seashore tonal memory test the most valuable in such a prediction.

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[1]Paul Hindemith, Elementary Training for Musicians (New York: Associated Music Publishers, 1949), p. 182.

[2]Frank S. Salisbury and Harold B. Smith, "Prognosis of Sight Singing Ability of Normal School Students," Journal of Applied Psychology, XIII (1929), 425-439.

[3]Charles D. Dean, "Predicting Sight Singing Ability in Teacher Education," Journal of Educational Psychology, XXVIII (November, 1937), 601-608.

Ortmann investigated the effect of melodic memory as part of aural perception.[1] The subjects were required to immediately notate short melodic phrases of five notes each as they were played on the piano. The results of this study enabled Ortmann to list, in order of difficulty, certain characteristics of melodic material. Conjunct and disjunct motion with wide interval leaps were found to be most difficult to perceive. This study exemplifies the isolated factor approach which is similar to the present study.

In the experimental study by Ottman a number of factors were investigated utilizing several standard published tests as well as tests devised by Ottman himself.[2] The specific standard tests were The Seashore Measures of Musical Talent, The American Council on Educational Psychological Examination for College Freshmen, and The Nelson-Denny Reading Test (music reading). The factors and/or variables examined and compared in this study included tonic memory, melodic modulation, melodic dictation with and without rhythm, identification of isolated intervals, spelling of isolated intervals, singing of isolated intervals, music literacy and two questionnaires--one for faculty evaluation

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[1]Otto Ortmann, "Some Tonal Determinants of Melodic Memory," Journal of Educational Psychology, XXIV (September, 1933), 454-456.

[2]Ottman, op. cit., p. 93.

of individual student musicianship and one for students to furnish general information.

The subjects for Ottman's study were three second-year music theory classes at North Texas State College (University) containing a total of 52 students. This group of students were not considered as a sample of the population and therefore, the "study should be considered as a descriptive investigation of this particular situation wherein certain avenues for further research may be made apparent."[1]

The criterion for measurement in this study was an unidentified melody by Luigi Cherubini which, because of its diverse musical content, was considered to be a suitable melody for such a purpose.[2] The criterion pre-test displayed a Spearman-Brown reliability of r = .861 and the post-test a Spearman-Brown reliability of r = .904.

Of particular interest to this author was the use of an exact duplicate of the criterion melody in terms of pitches and key but notated completely in half-note values to eliminate the rhythmic element.

> Each of the fifty-two subjects was asked to sing this melody individually and errors in pitch were circled on the examiner's copy in the same manner as was done on the original criterion melody. Although this test was given before the post-test of the criterion melody and in spite of the fact that this version of

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[1] Ibid., p. 93.

[2] Ibid., p. 239.

> the melody was in the same key as the original, therefore causing all intervallic relationships to appear staff-wise the same as before, still none of the subjects appeared to recognize this rhythmless melody as the one they had sung before. . . . Most of the subjects made fewer pitch errors when the element of rhythmic reading was eliminated. Improvement in reading pitch took place for thirty-nine subjects, ranging in item improvement from one less pitch error to twenty-four fewer pitch errors, or from 2.86 per cent improvement to 100 per cent improvement.[1]

The statistical results of Ottman's study yielded no significant relationship between the criterion and any musical or mental element measured by the employed standardized tests. The only exception that might be considered in the preceding statement is the Seashore pitch test; its correlation coefficient with the criterion was .300. It was the lowest statistically significant coefficient obtained and it was significant at the .05 level only.

Other results of this study, measured by original tests of Ottman, indicated: (a) "music literacy" (the ability of a sight-singer to hear mentally what is seen in the printed score) displayed the largest degree of relationship to the sight singing criterion being expressed with the high correlation coefficient of .733; (b) a correlation of r = .678 of the six interval tests as a group with the criterion; (c) scores of the Melodic Dictation, Melodic Modulation, and Tonic Memory tests all had positive correlations with the criterion scores and were statistically

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[1] Ibid., pp. 88-89.

significant at the .01 level; and (d) of the seven correlation coefficients produced by the two questionnaires, four were statistically significant at the .01 levels: "Subjects' Self-Evaluation of Sight-Singing Ability (r = .662); Faculty Evaluation of Subjects' Musicianship (r = .517); Subjects' Active Musical Participation (r = .499); . . . and Subjects' Self-Evaluation of Musicianship (r = .352)."[1]

A more recent investigation by Read, also conducted at North Texas State University, dealt with selected variables in relation to sight singing ability.[2] The subjects for this study were 125 undergraduate students selected for membership in the A Cappella Choir and the Chapel Choir at North Texas State University. The purpose of the study was the statistical comparison of twelve selected musical variables with seven extra-musical variables.

The criterion variable for the comparisons was the test score obtained from an original sight singing test given to each subject. The subject's music theory grades in ear training and keyboard technique, his permanent records in the Registrar's office, the subject's responses to an original questionnaire designed to obtain pertinent information about his environmental background and musical experience, and also the subject's placement on an original

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[1] Ibid., pp. 223-24.

[2] Read, op. cit.

rating scale of music interests supplied data for the variables under investigation.

Three standardized tests--The Seashore Measures of Musical Talent, The Gordon Index of Musical Insight, and The American College Testing Program--were also used to supply additional data along with a "Pure Tone Threshold Test" administered by the North Texas State University Speech and Hearing Clinic.

Conclusions drawn from the results of the study indicate that the student excelling in sight singing ability tends to display more natural musical ability, has had more formal classwork in music and appears to be more intelligent than the student registering a low level of sight singing ability.

The similarities of the design, selection of variables, and their application to Read's study and that of Ottman cannot be dismissed as simply coincidence. Read's study was more or less a reapplication of Ottman's study to a different experimental population producing similar conclusions from the results. Replication is, of course, needed and appropriate.

The effects of scale, harmony, and tonality related to interval accuracy in melodic sight singing was the subject of a study by Marquis.[1] That experimenter also

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[1]James H. Marquis, "A Study of Inteval Problems in Sightsinging Performance with Consideration of the Effect of Context" (unpublished Ph.D. dissertation, State University of Iowa, 1963).

investigated the relationship of scale, harmony, and tonality to the basic difficulties of interval quality. The element of rhythm was present in this study but controlled by simple usages. To accomplish this, Marquis approached the problem three different ways as stated in the following hypotheses related to first-year college-level sight singing students:

1. The percentage of errors made in singing a music interval will differ, depending on the context in which the interval appears.

2. Those who make errors in singing a given interval presented in melodic context will tend, also, to make errors in singing the same interval presented in isolation.

3. The percentage of errors made in singing an isolated interval at sight differs from that made in singing the same interval under different conditions of context.[1]

Two criterion tests were devised and tested for reliability and validity--the Sightsinging Criterion and the Isolated Intervals Criterion tests. These tests were designed to produce statistics which would test the above stated hypotheses. The Sightsinging Criterion was found to have a reliability of .979 (Spearman-Brown), significant at .01 level of confidence. Validities of .776 and .828 were drawn from correlation coefficients with grade points in the sight singing and ear training course and scores on a semester Aural Skills Dictator Test which evaluated interval scale

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[1] Ibid., p. 5.

and chord perception; both were significant at .01 level. The Isolated Intervals Criterion was found to have a reliability of .830 (Spearman-Brown), significant at .01 level of confidence, and internal validity was claimed.

Like interval items in the Sightsinging Criterion were classified, according to their contextual settings, into three categories: Simple, Moderately Complex, and Complex. Item to item comparisons were made of multiple sets of interval items with each set consisting of a single item taken from each categorized contextual setting. The analysis included 45 complete single-interval-item sets from each of the three contextual categories and 14 partial single-interval-item sets relating to only two contextual categories.

The descending tritone, ascending minor sixth, ascending and descending major sixth, and the descending major seventh intervals could not be formed into sets, since their items were all present under the same contextual conditions in the test melodies. Therefore, they were not compared for melodic setting error differences. However, these intervals were included in the comparison with isolated interval sight singing.

The subjects for Marquis' study were 52 first-year music theory students at the University of Iowa. The tests were administered individually and privately with all performances recorded on magnetic tape. In the interest of

having a student feel as relaxed as possible, the administrator gave the tests rather than employing a structured tape-recorded presentation. There are merits to this approach, but it also allows the entrance of contaminating factors into the test situation. Also, when the subject made a mistake, he was stopped, corrected by the administrator and then allowed to continue on commencing at a point prior to the place of error. This is a form of reinforcement, but also a form of contamination.

Because of the depth and breadth of the statistical results of this study, an attempt won't be made to reproduce the numerous facts, figures, and charts which Marquis derived from the investigation of each interval. However, interested readers are referred to that section of Marquis' dissertation.[1]

The results indicated acceptance of the first hypothesis, rejection of the second and acceptance of the third. In the words of Marquis this implied that:

1. First-year college level music students are significantly affected in sightsinging by differences in contextual settings of the intervals.

2. Ability or lack of ability in the singing of an isolated interval does not directly affect the singing of that interval in melody.

3. In melodic sightsinging, ability to perceive the basic quality of intervals is

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[1] Ibid., pp. 114-160.

> considerably less important than ability to perceive the scalar, harmonic, and tonal changes across or surrounding intervals.[1]

One of Marquis' suggestions for further research concurs with one amplified in the present investigation as well; specifically, a comparison of sight singing material which is key-oriented with one group referring to key signatures and the other group using accidentals before the notes only.

The findings of Marquis have direct bearing on the present study as the contextual environment is the prime variable investigated by both. A recent study by Buttram also deals with the subject of context in which an interval is presented; and, although the study does not directly involve sight singing, its implications most certainly relate to it.[2] The subjects for this investigation were 1,678 freshmen and 1,071 sophomore theory students from 46 colleges and universities in 30 states. A study of such breadth and depth can only yield meaningful results with a high probability of its being a representative sample.

Buttram investigated the influence of four factors--interval quale, pitch distance, tonal context, and relative distinctiveness--on the identification of musical intervals

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[1] Ibid., p. 173.

[2] Joe B. Buttram, "The Influence of Selected Factors on Interval Identification," Journal of Research in Music Education, Fall, 1969, pp. 305-15.

presented in a harmonic context. The term "quale," used in psychology, refers to the combination of two different musical tones resulting in a unified, distinctive effect possibly serving as a basis for interval identification. The feeling of harmony or tonality was created by the initial sounding of I-V-I chord progression before each interval was presented for identification. Then the tones composing the interval presented were drawn from those contained in the I, IV, or V chords of the same key.

Influence of context was accomplished through the difference in selection of the two interval pitches as well as by comparison to the control. Therefore, the first and second presentations utilized different tones for each interval allowing comparison of results in two situations of context.

The questions posed for this study were stated in null hypothesis form:

1. There is no difference in the accuracy of identification of intervals between the control version and one designed to reveal the influence of interval quale.

2. There is no difference in the accuracy of identification of intervals between the control version and one designed to reveal the influence of pitch distance.

3. There is no difference in the accuracy of identification of intervals between the control version and one designed to reveal the influence of tonal context.

4. There is no difference between the relative distinctiveness of intervals as identified in a control version and in versions designed to reveal the influence of quale, pitch distance, tonal context and melody.[1]

The test administered to the 2,749 subjects consisted of five versions of the same material--two presentations of each interval contained in the octave. The same intervals appeared in all five versions in a varied order of presentation. Development of "key feeling" was avoided through juxtaposition of the intervals and the pitch range was confined to an octave above and below middle "C."

Reliability, established by the split-half technique, for two repetitions of each interval for each of the five versions of the test ranged from .89 to .92 with interval validity also claimed. Four of the five versions related to the hypotheses previously stated with the fifth used as the control. To allow for widespread simultaneous testing and control of variables, the test was recorded on tape as were the instructions and practice examples. The subjects identified the intervals through written response.

Results of the testing indicated the rejection of all four null hypotheses significant at the .01 level of probability. This was the case for both the freshman and sophomore groups as well as the total sample population.

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[1]Ibid., p. 312.

Of particular interest are the results of the test versions examining context and melody. Although the highest accuracy, with a mean of 14.3 for the total group, was in the melodic version, the next highest occurred in the context (within a harmonic framework) version registering a mean of 13.2 for the total group.

The order of difficulty of intervals, which was established in the control version, varied somewhat in the four experimental versions. Only the octave, shown to be the most distinctive interval, maintained its position. The conclusions to be drawn from this situation is that ordering or classification of intervals considered typical of any context is questionable.

Buttram sums up the resulting conclusions of his study stating,

> Interval identification, as it occurred in this study, might best be described as a series of judgments based on a variety of characteristics of the interval and on the experience of the subjects with these characteristics.[1]

The factor of an accompanying duplicate pitch influencing pitch accuracy of a performer as opposed to an unaccompanied performance was investigated by Vorce testing the following five hypotheses:[2]

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[1] Ibid., p. 315.

[2] Frederick W. Vorce, Jr., "The Effect of Simultaneous Stimulus on Vocal Pitch Accuracy" (unpublished Ph.D. dissertation, The Florida State University, 1964).

1. Subjects perform with greater accuracy when there is a time-lapse between the stimulus and the response than when the stimulus is sounded simultaneously.

2. Subjects perform with a tendency in the direction sharpness (higher cps) rather than flatness (lower cps) when compared to the stimulus.

3. There is not a consistent pattern of differences between individual subjects or groups.

4. Verbal conditioning produces a measurable difference in pitch performance in the direction of the conditioning process.

5. Subjects do not perform with the same accuracy in each trial.[1]

The subjects, 40 music students at Florida State University, were randomly divided into five groups of eight subjects each--one group for each hypothesis to be tested--and were asked to vocally respond to mixed combinations of two musical pitches, accompanied and unaccompanied. The two stimulus pitches were A = 440 and Eb = 330 with each pitch sounded simultaneously with the subject's response for the accompanied treatment. The unaccompanied treatment consisted of the pitch being sounded, then ceasing and, after a time delay, the subject responding. Other verbal directions were given to influence conditioning for the different hypotheses tested. All tests were recorded on magnetic tape and were later analyzed using a Conn Chromatic Stroboscope.

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[1] Ibid., p. 24.

The main conclusion from Vorce's experiment that is pertinent here is the indication that accompanied performances were highly superior to unaccompanied performances with all trial results significant at the .01 level of confidence. The vocal transposition of an octave by certain (male) subjects seemed to make no difference in the results, according to Vorce's data analysis. Both of these facts are pertinent to the present study related to the experimental treatment used.

Effectiveness of Various types of Drill and Drill Procedures as Teaching Devices for Improved Sight Singing Ability

Maximum achievement in the acquisition of skills related to music theory is of constant concern to the theory pedagogist. Much has been accomplished through the utilization of electronic tape recording devices in the field of ear training and more recently in the field of sight singing as well. The marketable pricing of electronic pianos with sophisticated class instruction systems have revolutionized and accelerated the keyboard aspect of theory as well as the concept of class piano. Teaching machines can be programmed for instruction of music fundamentals up through any level of information desired. The one underlying benefit for both the student and the instructor is the limitless opportunity for drill, the necessary ingredient to achievement of the highest possible level of any skill ability.

Experimenters and teachers have constantly searched for ways to aid and accelerate the teaching of skills at least as far back as the Guidonian Hand. Experimental studies related to different kinds of drill in sight singing have only recently increased in number, due mainly to technological advancement. Earlier studies by Bean,[1] Stokes,[2] and Christ[3] have pointed the way to further experimentation. Examples of this are the several experiments done with the tachistoscope, a device used to accelerate skills in word-reading, employed by Stokes and Christ in their studies.

The study by Cookson, conducted at Northwestern University in the summer of 1949, was an initial application of tape recorders as a teaching device for music skills.[4] A class of sixteen subjects received ear training drill over a six-week period involving occasional reinforcement tests and a final placement test. Scores from the final test compared with scores of regular music theory classes indicated that

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[1]Kenneth L. Bean, "An Experimental Approach to the Reading of Music," Psychological Monographs, L (1938), 1-79.

[2]Charles F. Stokes, "An Experimental Study of Tachistoscopic Training in Reading Music" (unpublished Ph.D. dissertation, Teachers College, University of Cincinnati, 1944).

[3]William E. Christ, "The Reading of Rhythm Notation Approached Experimentally According to Techniques and Principles of Word Reading" (unpublished Ph.D. dissertation, Indiana University Music Library, 1953).

[4]Frank B. Cookson, Recordings and Self Tutoring (Cleveland: The Brush Development Co., 1949), pp. 5-8.

75 percent of the experimental class accomplished twice the amount of ear training material that would normally be expected of such a class.

Spohn further investigated the potential of tape-recorded music drill, realized in Cookson's study, in its application to the skill of "aural comprehension."[1] This experiment employed the classic two-group (control and experimental) design with results emanating from the comparison of pre-test scores with post-test scores. The subjects for the study were music students at Ohio State University, who, through test scores on the Ohio State Psychological examination, music entrance tests, applied instrumental area, and sex were divided into two matched groups.

The control group developed aural comprehension through conventional classroom methods, whereas the experimental group, using the same material, developed their aural comprehension utilizing specially prepared tape recordings outside of class. The time allotted to aural comprehension development was equal for both groups.

The null-hypothesis for the study stated:

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[1]Charles L. Spohn, Jr., "An Exploration in the Use of Recorded Teaching Material to Develop Aural Comprehension in College Music Classes" (unpublished Ph.D. dissertation, Ohio State University, 1959).

> As a result of specially prepared tape recordings, to be used outside the classroom, the students of the experimental class will not develop better aural comprehension than will the control class who develop aural comprehension through conventional-classroom methods.[1]

This null-hypothesis was rejected at the .05 level based on a comparison of decrease in the number of errors made between the pre-test and post-test of both groups. The control group registered an average percentage decrease of 57.68 percent, while the experimental group displayed an average percentage decrease of 80.33 percent leaving a difference of 22.65 percent between the two groups in percentage decrease.

The obvious conclusion drawn from these results is that the use of tape-recorded drills and exercises is a valid method for development of aural comprehension. Recommendations made by Spohn at the conclusion of the study have been the basis for experiments conducted by researchers since then.

One of the follow-up experiments done in relation to the above study was also done by Spohn himself, assisted by Poland, under a United States Government funded grant.[2]

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[1] Ibid., p. 81.

[2] Charles L. Spohn and William Poland, An Evaluation of Two Methods Using Magnetic Tape Recordings for Programmed Instruction in the Elemental Materials of Music, Final Report of Title VII, Project No. 876, National Defense Education Act of 1958, Grant No. 7-34-0430-172 (Columbus, Ohio: The Ohio State University, November, 1963).

This study employed a four-group design representing four different treatments of equivalent materials. Three basic elements of intervals, rhythms, and tone groups were isolated into three separate ten-week studies. All subjects were given the same pre-tests and post-tests at the beginning and conclusion of each ten-week period of training corresponding to the Fall, Winter, and Spring quarter-terms at Ohio State University.

The treatment groups for all three elements investigated employed the following treatment combinations:

1. Aural Stimulus-Written Response (treatment no. 1)
2. Visual Stimulus-Voice Response (treatment no. 2)
3. Aural Stimulus-Voice Response (treatment no. 3)
4. Visual Stimulus-Written Response (treatment no. 4).[1]

The second and third treatments are particularly relevant to the present study. They produced the following statistical results:

1. Interval Study--yielded F-ratios of 4.61 (significant at .05) for the stimulus and 12.30 (significant at .01) for the response, indicating both the stimulus and the response significantly affect the experimental results of the second treatment. The third treatment results were complicated by significant interaction with an F-ratio of 4.36

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[1] Ibid., p. 39.

(significant at .05). However, the stimulus yielding F = 12.38 (significant at .01) and the response F = 5.24 (significant at .05) underscored the fact that there is no better training than the task itself.

2. Rhythm Study--no significant differences were obtained from the second and third treatments of this element.
3. Tone Group Study--the second treatment yielded an F-ratio of 6.35 (significant at .05) for the voice response indicating that it is superior to the written response treatments. The third treatment yielded no significant difference.

The conclusion one can draw from the results of the study by Spohn and Poland, related to voice response, is that the treatment using a visual stimulus and calling for a vocal response can be considered valid in a similar environment of tape-recorded programmed instruction involving intervals and tone groups.

The tachistoscope, the device used by Stokes[1] and Christ[2] in their investigations, was also employed by

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[1]Stokes, op. cit.

[2]Christ, op. cit.

Barnes,[1] Hammer,[2] and Ray[3] in their investigations of selected drills and their influence on certain factors affecting sight singing ability.

Barnes' study dealt with two primary purposes: (1) investigation of the effect of group drill in sight singing selected intervals upon the subject's ability to sight sing those intervals and (2) determination of the correlation between that intervallic sight singing ability and the ability to sight sing melodies composed of those same intervals.

Secondary investigations of the study determined an order of interval difficulty and compared sight singing modal or modulating melodies with sight singing major, minor, or non-modulating melodies in relation to the ability to sight sing intervals.

An original interval sight singing test and an original melody sight singing test were developed by Barnes and thoroughly checked for reliability and validity. The subjects for the experiment were 60 members of first-year theory class at Indiana State Teachers College and were

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[1]James W. Barnes, "An Experimental Study of Interval Drill As It Affects Sight Singing Skill" (unpublished Ph.D. dissertation, Indiana University, 1960).

[2]Harry Hammer, "An Experimental Study of the Use of the Tachistoscope in the Teaching of Melodic Sight Singing," Journal of Research in Music Education, XI (1963), 44-45.

[3]Harry B. Ray, "An Experimental Approach to the Reading of Pitch Notation" (unpublished Ph.D. dissertation, Indiana University, 1964).

placed into matched experimental and control groups. The two groups received the same classroom instruction, the only difference being an additional ten hours and twenty-five minutes of tachistoscopic drill in the sight singing of intervals over a ten-week period.

Intervals used in the drills as well as the tests were limited to a fifth--major and minor seconds and thirds, perfect fourths and fifths. However, because of its difficulty, the tritone was excluded. A practical singable range of Bb to d^2 was also decided upon. Notation for the interval drills and test was in half-notes with necessary sharps or flats placed before the notes eliminating the use of key signatures.

Experimental drill sessions were accomplished, as a group, in a darkened room using a microfilm projector with a tachistoscopic lens attachment. Intervals were flashed upon a screen with the time interval of exposure varied from unlimited progressing to 1/100 of a second. The initial pitch of the interval was sounded with the students responding with both pitches.

Several results produced by this experiment are relevant to the present study. The performance of the experimental group was significantly better than the control group in both the sight singing of intervals (mean difference of 8.90 at the .01 level of confidence) and of melodies (mean difference of 7.45 at the .05 level of confidence)

with the melodic sight singing ability being slightly less significant statistically.

A high correlation (.916) was found between intervallic and melodic sight singing abilities, this being derived from the correlation of Interval Test scores and Sight Singing Test scores and found to be at the .01 level of confidence. However, the correlation between the improvement in intervallic sight singing ability and the improvement in melodic sight singing ability, although very significant (.525) and also at the .01 level of confidence, was not as high as the correlation between intervallic and melodic sight singing abilities.

The order of interval difficulty resulting from Barnes' study is of particular interest. Since it was derived from the same limitation of intervals employed in the present study, Barnes' chart[1] is reproduced here for later reference. This interval hierarchy was determined by the results of 208 tests, in which each interval was presented five times in each direction, totaling 2,080 occurrences and, therefore, can possibly be considered significant.

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[1]Barnes, op. cit., p. 71.

ORDER OF DIFFICULTY OF INTERVALS INVESTIGATED AS DETERMINED BY ANALYSIS OF INTERVAL TESTS

Interval	Direction	Number of Times Presented	Number of Times Missed	Rank Order of Difficulty
Major third	Down	1040	432	1
Perfect fifth	Up	1040	394	2
Perfect fifth	Down	1040	382	3
Perfect fourth	Down	1040	372	4
Perfect fourth	Up	1040	345	5
Major second	Down	1040	342	6
Minor third	Down	1040	315	7
Major third	Up	1040	287	8
Minor third	Up	1040	284	9
Major second	Up	1040	257	10
Minor second	Up	1040	161	11
Minor second	Down	1040	107	12

The interval drill was found to be an effective aid to both sight singing of major, minor, and non-modulating melodies as well as modal and modulating melodies. However, because comparisons were made by dividing each group into highest and lowest quartiles, the small number of subjects in each quartile lessened the degree of significance in relation to the other results of the study.

The results of Barnes' study indicate that tachistoscopic drill was an effective method of teaching the sight singing of intervals. The studies of Hammer[1] and Ray,[2] on the other hand, yielded results that were divided as to

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[1]Hammer, op. cit.

[2]Ray, op. cit.

the effectiveness of tachistoscopic drilling of subjects in selected musical skills.

Hammer used a tachistoscopic attachment on the lens of an overhead projector during tonal pattern practice sessions with a class of fourth-grade students. The results of his study showed tonal pattern practice with the tachistoscope significantly superior to conventional methods of tonal pattern practice.

Ray experimented with the tachistoscope comparing the results of two types of drill with pitch patterns. The experimental group, receiving the tachistoscope drill treatment, used pitch patterns of varying length and complexity and not identified with a particular key or mode. The control group, drilling from mimeographed sheets, used pitch patterns related to specific keys and modes. The subjects were first-year music students at Western Michigan University.

The measurements of the achievement of the two groups were based on scores derived from an original sight singing test administered both as a pre-test and post-test. The experimental groups received four half-hour drill sessions each week over a ten-week period while the control group received their practice in the conventional manner.

Results of the statistical comparisons showed no significant difference between the groups and thereby questioned the value of the tachistoscope drills in this

particular experimental situation. However, one must consider the possibility of contamination in this study due to the differing nature of the musical materials used by the two groups. Duplicate materials might possibly have altered the results of Ray's investigation.

Although not directly connected with the skill of sight singing, the study by Ihrke which investigated the sophisticated fusing of tape recorders, computers, and teaching machines into unified training systems for music theory skill development should be cited.[1] A progress report on an initial study in rhythmic training, implemented at the University of Connecticut, described the combined use of an electric organ, stereo tape recorder and an electrical device called a "rhythm monitor" in teaching rhythmic dictation.[2] The "rhythm monitor," the unique experimental feature, employs error lights indicating earliness or lateness of responses.

Twenty-four elementary education students participated in the study with seven in the experimental group and seventeen in the control group. The resulting data indicated that "automated rhythm training" is a valid and effective training method. The study also indicated that

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[1]Walter R. Ihrke, "Automated Music Training," Journal of Research in Music Education, XI, No. 1 (Spring, 1963), 3-20.

[2]Walter R. Ihrke, Automated Rhythm Training, Council for Research in Music Education Bulletin No. 7, Spring, 1966, pp. 35-37.

the experimental method of rhythmic perception training is as effective as traditional methods of training rhythmic perception.

The combination of a programmed self-instructional sight singing method and the medium of the tape recorder was compared to the conventional teacher-classroom method by Kanable at Northwestern University.[1] Using as subjects high school students enrolled in a three-week summer music program on the Northwestern University campus, control and experimental groups were randomly formed and given a pre-test in sight singing which was recorded on magnetic tape for scoring purposes.

Both groups covered the same basic material and participated in the same amount of instruction time--twelve fifty-minute periods--with the only difference being the tape-recorded programmed self-instructional sight singing method applied to the experimental group. At the conclusion of the training period, the same sight singing test used as a pre-test was again administered to both groups as a post-test.

The questions investigated by Kanable are stated as the following null hypotheses:

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[1]Betty Mae Kanable, "An Experimental Study Comparing Programmed Instruction with Classroom Teaching of Sight Singing" (unpublished Ph.D. dissertation, Northwestern University, 1964).

1. There is no significant difference between sight singing scores of subjects as a function or method of training.

2. There is no significant correlation between sight singing scores of experimental subjects and ability in tonal memory.

3. There is no significant correlation between sight singing scores of control subjects and ability in tonal memory.[1]

Results of the measurement of scores, using an analysis of variance of error scores, indicated acceptance of the first null hypothesis. In other words, the tape-recorded sight singing instruction did not prove to be significantly more effective than the conventional classroom instruction. However, using a "t" formula for determining the ratio of the difference between related scores, results indicated t = 5.05 for the experimental group (significant at .01 level of confidence) and t = 3.02 for the control group (significant .02 level of confidence).

The second null hypothesis was rejected using the Spearman rank order correlation in which the experimental group showed correlation significant at the .05 level of confidence on both the pre-test and post-test between scores of the Test of Tonal Memory and Error Detection and scores of the Sight Singing Test. The last-mentioned tests were given to all students before the selection of the control and experimental groups as a screening procedure.

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[1] Ibid., p. 17.

Thus, there was significant correlation between sight singing scores of experimental subjects and ability in tonal memory.

The Spearman rank order correlation was also used to test the third null hypothesis with the results indicating its acceptance. The control group did show significant correlation at the .05 level between ability in tonal memory and pre-test sight singing scores, but correlation between tonal memory ability and sight singing scores on the post-test was not significant.

Although the results were not significant enough in Kanable's study to claim complete support, they do indicate that the use of such a tape-recorded programmed self-instructional method is just as effective, if not moreso, as classroom instruction in sight singing, a fact which is quite relevant to the present experimental design.

Contributing to the limitations of the present study are the conclusions derived from Helbling's study comparing the effects of using the "whole" method and the "part" method in teaching sight singing.[1] The subjects participating in the experiment were 26 selected undergraduate elementary education majors at Asbury College who had little or no previous formal study in sight singing.

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[1]DeVon W. Helbling, "An Experimental Study of the Relative Effectiveness of 'Whole' and 'Part' Methods of Teaching Sight Singing" (unpublished Ph.D. dissertation, Indiana University, 1965).

Using the parallel group technique, 13 class members of the Winter quarter section of the course were equated with 13 class members of the Fall quarter section to act as the experimental subjects. The Fall quarter experimental subjects were taught sight singing using the "whole" concept, and the Winter quarter experimental subjects learned sight singing through use of the "part" concept of teaching. Twenty class sessions were devoted to teaching each concept.

An original sight singing test, containing five melodies, was constructed by Helbling. The melodies corresponded in type and level to those intended as the teaching-learning goal of the program of study. The test claimed content validity and, utilizing the test-retest method, was found to have a reliability of .97. This test was used as the pre-test, midterm test, and post-test to measure the relative progress of the two experimental groups. All tests were recorded on magnetic tape for uniform scoring purposes.

The sight singing pre-test, midterm and post-test scores were compared measuring the relative progress of the two experimental groups. Using difference scores, the *t* test was employed to discern whether a significant difference existed between the two sets of "difference" scores.

The comparison of pre-test to post-test scores produced a mean difference of 2.01 in favor of the Whole Method Group, but was not statistically significant. The pre-test comparison with the midterm test scores yielded a mean difference of 6.61 in favor of the Part Method Group,

found to be significant at .05 level of confidence. The comparison of midterm scores with post-test scores showed a mean difference of 8.62 favoring the Whole Method Group and significant at .01 level of confidence.

A general conclusion that may possibly be drawn from these results is that a combined use of the "whole" and "part" concepts might be a more effective approach to the teaching of sight singing with the "part" method emphasized in the early stages and the "whole" method employed later. This combined concept is similar to a method of approach advanced by Kunkle.[1] If the "part" method is more effective in the beginning stages of sight singing training, it reinforces the approach that has been incorporated in the design of the present study.

More recent experiments with variation of drill procedures to study their effects have been done by Wilcox,[2] Tucker,[3] and Justus;[4] but all have been basically concerned

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[1]Robert F. Kunkle, "A Direct Approach to Sight Singing," Music Educators Journal, June-July, 1950, p. 41.

[2]Eunice A. Wilcox, "The Effects on Sight Singing of Voice Class Instruction Utilizing Variants of Traditional Vocalises" (unpublished Ph.D. dissertation, Michigan State University, 1968).

[3]Gerald L. Tucker, "The Influences of Isolated Rhythmic Drill on Growth in Sight Singing" (unpublished Ph.D. dissertation, The University of Oklahoma, 1969).

[4]Lane D. Justus, "Evaluation of an Innovative Instructional Design for Sight Singing" (unpublished Ph.D. dissertation, University of Arizona, 1970).

with the improvement of ability to sight sing music of a tonal nature; although Wilcox had hoped that drills devised for that study would aid the sight singing of atonal music as well. Unfortunately, significant results were not obtained in that investigation.

Atonal Music Investigations

The only documented direct investigation into atonal sight singing implemented so far has been by Sherman and Hill as one part of a fourteen-part investigation of melodic perception in tonal and atonal environments.[1] This elaborate study, made possible through a grant from the Office of Education of the U.S. Department of Health, Education and Welfare, was implemented on the campus of Ball State University in Muncie, Indiana.

The purposes of the study were stated in three questioning hypotheses.

1. Will progress in the aural and visual perception of music through instruction based upon atonal organization transfer to progress in the aural and visual perception of tonal music.

2. Will students with different levels of ability show similar attainment in the aural and visual perception of music under conditions of
    a. selected responses, and
    b. constructed responses?

3. Will students with different levels of musical ability respond with similar

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[1]Sherman and Hill, op. cit.

> attitudes toward tape-recorded self-instruction?[1]

The first and third hypotheses are directly relevant to the present investigation as is this statement made in relation to the above hypotheses.

> Abundant evidence exists which points out that formal instruction in music is still conducted today primarily in tonal idioms, although contemporary music tends to be atonal in nature. The most common justification for this situation frequently centers around two issues: first, the majority of "classic" or serious music is in tonal idioms, much of it centuries old; second, if fundamental instruction were given in contemporary atonal idioms only, students would be handicapped with respect to the vast majority of older serious music which is tonal in nature. This project was directed primarily toward the second of these common justifications; i.e., will atonal instruction transfer to tonal idioms?[2]

To administer such a multi-faceted study, an elaborate laboratory was constructed consisting of multiple student stations equipped with stereophonic tape recorders and head sets with a third of the stations being insulated booths in which sung (vocal) responses were performed.

An extensive examination, used as both the pre-test and post-test, was devised during the pilot year. It consisted of fourteen separate tests for which a wide selection of specially composed materials were stereophonically tape-recorded by various ensemble combinations of faculty

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[1] Ibid., p. 35.

[2] Ibid., p. 35.

instrumentalists. The tests measured the subject's recognition of musical intervals and melodies accompanied by one, two, and four other voices set in approximately equal numbers of tonal and atonal idioms.

There were four types of responses called for in the pre-test (post-test) examination: (1) selected response-aural, (2) selected response-visual, (3) constructed response-written, and (4) constructed response-vocal. The items also reflected varying degrees of difficulty relative to the context and complexity of accompanying voices as well as the relative difficulty of melodies compared to intervals. Nine degrees of complexity can be discerned beginning with the interval with one, two, or four other voices; the 3-4 note melody with one, two, or four other voices; and the 5-7 note melody with one, two, or four other voices.

An outline of the fourteen tests which comprised the pre-test (post-test) examination of Sherman and Hill's study follows:

PART I--SELECTED RESPONSE TO AN AURAL STIMULUS

Test 1. Intervals Accompanied by One Other Voice
72 Tonal-72 Atonal

Test 2. Intervals Accompanied by Two Other Voices
72 Tonal-72 Atonal

Test 3. Intervals Accompanied by Four Other Voices
72 Tonal-72 Atonal

Test 4. Three to Four Note Melodies Accompanied by:
One Other Voice 10 Tonal-10 Atonal
Two Other Voices 10 Tonal-10 Atonal
Four Other Voices 10 Tonal-10 Atonal

Test 5. Five to Seven Note Melodies Accompanied by:
One Other Voice 10 Tonal-10 Atonal
Two Other Voices 10 Tonal-10 Atonal
Four Other Voices 10 Tonal-10 Atonal

PART II--SELECTED RESPONSE TO A VISUAL STIMULUS

Test 6. Intervals Accompanied by One Other Voice
24 Tonal-24 Atonal

Test 7. Intervals Accompanied by Two Other Voices
24 Tonal-24 Atonal

Test 8. Intervals Accompanied by Four Other Voices
24 Tonal-24 Atonal

Test 9. Three to Four Note Melodies Accompanied by:
One, Two, and Four Other Voices
10 Tonal-10 Atonal

Test 10. Five to Seven Note Melodies Accompanied by:
One, Two, and Four Other Voices
10 Tonal-10 Atonal

PART III--CONSTRUCTED-WRITTEN RESPONSE TO AN AURAL STIMULUS

Test 11. Intervals Accompanied by One, Two, and Four Other Voices
24 Tonal-24 Atonal

Test 12. Three to Four Note Melodies Accompanied by:
One, Two, and Four Other Voices
10 Tonal-10 Atonal

PART IV--SELECTED RESPONSE TO AN AURAL STIMULUS

Test 13. Isolated Intervals
72 Tonal-72 Atonal

PART V--CONSTRUCTED-VOCAL RESPONSE TO AN AURAL STIMULUS

Test 14. Intervals Accompanied by One, Two, and Four Other Voices
24 Tonal-24 Atonal.[1]

One hundred music students at Ball State University were assigned to four treatment groups of 25 subjects each. Predicted grades, based on final course grades, were used in assigning the students to the four sections in such a manner as to avoid systematic bias. Sections one and two received entirely atonal class instruction, and sections three and four received entirely tonal class instruction. Laboratory instruction was entirely atonal in section one, mixed atonal and tonal in section two, entirely tonal in section three, and mixed tonal and atonal in section four. The complete examination was administered to all four groups prior to their instruction period and administered again at the conclusion of the experimental period. Approximately 70 of the original 100 subjects remained at the conclusion of the experimental year.

Rather than statistically relate the results of all fourteen tests, just the general findings are stated here, with the exception of the final test which relates directly to the present study.

All 42 analyses of covariance of the data, except one, indicated retention of the null hypothesis, set at the

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[1]Ibid., pp. G-1 through G-4.

.01 level displaying no significant difference between tonal and atonal instruction. These results, then, infer that instruction in atonal music will transfer to tonal music. There were also indicated tendencies and trends somewhat favoring the atonal idiom over the tonal idiom.

In reference to the second hypothesis, selected responses were found to be nearly perfect measures of perception, whereas, constructed responses illustrated a requirement of considerably more learning.

The attitudes toward tape-recorded self-instruction in a laboratory situation did not significantly differ between higher achieving and lower achieving students. This comparison of attitudes and opinions was measured using a specially prepared semantic differential type of instrument, the results of which produced data registering at the .01 level of confidence.

The fourteenth test, the final one of the examination series, involved a constructed-vocal response to a visual stimulus. There were 48 tonal and atonal medium range intervals, selected from tests one, two, and three, randomly arranged and notated on staff paper. Both the ascending and descending forms of each of the twelve intervals were selected, one each from tonal and atonal contexts. The students were required to sing these intervals, after being given the initial pitch of the interval, against recorded accompaniments of one, two, and four other voices.

The vocal response tests were given individually in the specially constructed vocal response booths and were recorded on magnetic tape for scoring purposes. One person corrected both the pre-test and post-test which yielded the following data:

ANALYSIS OF COVARIANCE
Test 14

Tonal Sources	df	ss_x	ss_y	ss'_y	df	ms'_y
Among	3	40.82	114.57	50.40	3	16.80
Within	64	1564.95	2246.65	1103.51	63	17.52
Total	67	1605.77	2361.22	1153.91	66	

F = .9592 df = 3/63 Probability = .4176

Atonal Sources						
Among	3	2.51	174.72	152.21	3	50.74
Within	64	1018.73	1526.22	662.15	63	10.51
Total	67	1021.24	1700.94	814.36	66	

F = 4.8272 df = 3/63 Probability = .0043

Total Sources						
Among	3	61.50	555.34	323.37	3	107.79
Within	64	4709.39	6554.47	2435.48	63	38.66
Total	67	4770.89	7109.81	2758.85	66	

F = 2.7882 df = 3/63 Probability = .0477

In these analyses of covariance, the pre-test score served as the covariate, and the post-test score served as the criterion. In this test, the F ratio of the atonal test (F = 4.8272) was most significant at less than the .01 level

of confidence with the tonal test registering an unsignificant F = .9592 and the total F ratio 2.7882 at the .05 level of confidence. The analysis of the atonal vocal responses item was the only one of the 42 analyses of covariance producing rejection of the null hypothesis (at the .01 level) that there is no difference between tonal and atonal music instruction.

The above statistical results indicate that further experimental research is needed in the area of atonal sight singing. The fact that this test was one of only two--the other being Test 13--that was restricted to intervals calls for the incorporation of melodic forms of atonal intervals studied in an atonal environment. This conclusion directly influenced the experimental design and selection of musical materials used in the present study.

Pilot Study

The present experimental study was administered, in a pilot situation, to students attending the four-week session of Youth Music at Michigan State University during the summer of 1970. Attending participants were high school music students who ranged from 15 to 18 years of age.

Two levels of theory were taught during Youth Music: Theory I presented basic fundamentals of music structure and Theory II introduced fundamentals of four-part writing and a heavy emphasis on sight singing and ear training. The Theory II classes were comprised of students who had

previously had Theory I and those who, on an initial placement test, scored in the upper 20 percent of that test. Two sections of Theory II, which met for five 50-minute periods each week, were selected as experimental and control groups for the pilot study.

Because of scheduling problems involving performance group rehearsals, true matching or random selection was not possible. Therefore, the experimental group, which met at eight in the morning, was comprised mainly of string, keyboard, and voice students. The control group, which met at two in the afternoon, was comprised basically of wind and brass students.

An intensified program of tonal sight singing was conducted during the first week of classes in which the main emphasis was placed on drill sheets of tonally arranged interval series. Numbers were employed as an aid to sight singing with increased interval accuracy. These sheets progressed from smaller intervals (seconds and thirds) to larger intervals (fourths and fifths) in much the same sequence as was administered to the first year college theory classes in the year of actual implementation. No key signatures were used; accidentals were written by each note requiring alteration and all were in the treble (G) clef.

At the conclusion of the week of tonal sight singing training, a tonal sight singing test was administered by individual appointment and recorded on tape. The test

progressed in difficulty from intervals of a second up to a fifth (excluding the tritone) as did the drill sheets. The results of the Tonal Sight Singing Tests yielded a mean of 40.20, standard deviation of 25.29 for experimental group. The tests administered to the control group yielded a mean of 39.78, standard deviation of 5.31, and a variance of 28.19.

The drill sessions in atonal sight singing were conducted in a language laboratory at Michigan State University and consisted of nine sessions in much the same manner as they would be administered to the college theory classes in the coming test year. Each drill unit contained twenty-five atonally arranged Interval Series printed on drill sheets. The implementation was executed in the same manner as planned for the actual experimental period.

After nine drill sessions were completed, two Atonal Sight Singing Tests were given in the laboratory in groups of five students each (widely spaced throughout the room) with their responses recorded on test tapes. The first half of the test was administered within the same environmental conditions as the drill sessions. There were twelve Interval Series which were the same for both the experimental and control groups with the organ accompaniment (for the experimental group) being the only difference. The second half of the test was administered with the contexts reversed; that is, the organ accompaniment was removed from the experimental group and given to the control group. As in the previous

test, the Interval Series were identical for both groups. Results of the Atonal Sight Singing Test A yielded a mean of 36.9, standard deviation of 8.31 and a variance of 68.99; and Test B yielded a mean of 31.40, standard deviation of 8.22, and a variance of 67.60 for the experimental group. Results of the Atonal Sight Singing Test A yielded a mean of 32.33, standard deviation of 10.30, and a variance of 106.00; and Test B yielded a mean of 32.44, standard deviation of 11.62, and a variance of 135.00 for the control group.

Since the situation was such that a matching of groups could not be accomplished, no statistically significant differences between the experimental and control groups were realized. However, changes in results of the Atonal Sight Singing Test B when compared with Test A did indicate effects of the treatment.

As the preceding data indicate, the experimental group's proficiency dropped in all but one case when the accompanying sonority was removed, which might have been due to the limited number (9) of atonal drills possible in the time allotted to the pilot study. The control group, on the other hand, showed some increase (particularly with higher scoring subjects) when the accompanying sonorities were added. A certain amount of confusion was evidenced in the results of the first two or three Interval Series (in most cases) when the accompaniment was added to the control group. These results would tend to indicate that the

accompanying sonority does affect (to an uncertain degree) proficiency in singing atonally arranged intervals.

Along with the contamination due to unmatched groups, the time limiting factor in Youth Music schedules demanded that the final tests be given in groups of five each in the language laboratory. The subjects were sufficiently spaced throughout the room to control auditory transfer between subjects as much as possible. Even so, particularly in the unaccompanied sections of the test, subjects could conceivably "cue in" on another subject's response although this was not evidenced during the evaluation of performance on the test tapes. The final tests in the actual experiment were, of course, given individually in as sound-proofed a room as possible using headphones and professional quality tape recorder.

The results of the pilot study with additional information through observation and a student opinion questionnaire indicated the following changes:

1. The tempo of the response (which, in the experimental group, is indicated by the tempo of the organ tones being sounded) was reduced to ♩= 30 or two seconds per note; it was observed that ♩= 60 was slightly fast for accuracy of response.
2. The control group in particular was urged to go through the complete Interval Series without repetition or "stepwise testing" of intervals once they commence; and correction was attempted after singing

the series or during the playback by the piano. This applied to both the drill sessions as well as the final tests.

3. Both groups were urged to anticipate vocally the correct note when singing with the playback of the correct Interval Series. In this way they could more accurately check their mistakes.
4. The length of the drill units were shortened from 25 to 20 items as fatigue and boredom were observed during the last few items on each drill session.
5. The upper range of the Interval Series was limited to d^2 (a ninth above middle C); E-flat was found by many to be a difficult note to produce. The lowest note remained Bb (below middle C).
6. The final tests were identical with only the order of administration of the test being changed, depending on which group the subject being tested belonged.

Summary

The information and commentary of this chapter presented the most recent studies directly concerned with the skill of sight singing as well as pertinent statements by reputable theorists and educators. Since the research of Ottman has produced a thorough anthological survey of the history of sight singing,[1] repetition of that aspect was deemed unnecessary in this presentation.

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[1]Ottman, op. cit.

The constant striving for accurate and efficient instruments for measurement of sight singing ability has been, and still remains, a prime concern of music theory instructors and researchers. The studies surveyed indicated a trend toward the use of several shorter items rather than one or two all-inclusive items in sight singing examination in order to allow for greater flexibility and separation of problematic factors. The tape recording of sight singing examination performances has also proven to be of aid in controlling consistency in grading and increasing the reliability of the examination.

Early studies to determine related factors influencing sight singing ability were accomplished by use of tests which combined these factors such as tonal memory, melodic memory, melodic modulations, interval identification, interval spelling, and interval sight singing. Scores from these tests were compared with scores of other previously administered tests both standardized and original. This approach does retain the "musicality" of such tests, but also allows confusion of results through interaction of the factors. Ottman's realization of this fact is shown in his instrumentation of testing the same population with the rhythmic elements extracted from the original criterion melody. More recent studies have had success by limiting investigations to just one or two elements that might influence sight singing ability.

Technological advancements have produced devices which have been incorporated into various approaches to instruction in ear training and sight singing as well as other areas of music theory. Several researchers, spanning almost four decades, have investigated various possible uses of the tachistoscope. The sophistication achieved recently in the medium of tape recording and the improved versatility of the recording machines had supplied still another vehicle for improved instruction of skills as well as aiding more accurate and widespread study.

The most direct influence on the present investigation were the results and conclusions drawn from a similar study, comparing melodic perception in tonal and atonal contexts, by Sherman and Hill.[1] Since that study uniquely explores the skill of sight singing in an atonal environment in its final test of fourteen, much space has been devoted, in this chapter, to the presentation and discussion of that study.

Factors derived from certain conclusions of all of the reviewed documentations have, in varying degrees, contributed to the experimental design, limitations, and instruments of measurement of the present study.

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[1]Sherman and Hill, op. cit.

CHAPTER III

DESIGN OF THE STUDY

Sample

Sixty first-year music theory students at The University of Calgary participated in this experimental study during the winter term of 1971. The majority of these subjects were enrolled as music majors. However, because of a common first-year curriculum, some students were enrolled as tentative music majors. Only two subjects were definitely non-music majors--one in the experimental group and one in the control group. The subjects' ages originally ranged from 18 to 53 years; but attrition changed the upper age to 42 years with the majority ranging from 18 to 20 years of age. There were 25 male subjects and 35 female subjects at the beginning of the experimental period. An attrition of 25 percent occurred throughout the term and 17 male subjects and 28 female subjects remained at the conclusion of the 24 drill sessions.

The initial sixty subjects were assigned, by computer scheduling, to three class sections of second term first-year music theory. Since the 9 A.M. section contained only ten students, these students voluntarily adjusted their

class schedules to attend either the 10 A.M. or 12 noon class sections. Through a toss of the coin (the majority of seven tosses) the 10 A.M. class section with an enrollment of 35 students was designated the experimental group, and the noon class section with an enrollment of 25 students became the control group.

Permission was granted by the head of The University of Calgary music department to conduct the Atonal Sight Singing Drills as part of the regular second term laboratory instruction in music theory. The drill sessions were administered in a standard language laboratory. Each drill session lasted approximately 22 minutes and was given at the beginning of two of the three weekly laboratory class periods.

Winter weather conditions and illnesses were the main causes of student absenteeism. To insure a large number of subjects receiving all 24 drill sessions, make-up sessions were held in the evening once every two weeks for those subjects missing drill classes. Thirteen experimental group subjects and two control group subjects failed to complete all 24 drill units in spite of the evening make-up sessions.

Drill Instrumentation

The uniqueness of this experimental study demanded instruments of drill and measurement which were also somewhat unique. The approach used in this study is similar to

the design used in Barnes' study.[1] All of the musical materials for tests and drills were originals devised with the approbation and guidance of the advisors to this study.

Interval Series

Interval Series containing five pitches (four intervals) were notated in whole-notes in the G (treble) clef. No key signatures were used. Upward and downward inflection of natural pitches was indicated using accidentals before the appropriate notes. Whole-note values were used to indicate an indefinite duration. The Interval Series were limited to a vocal range of Bb up to d^2. Major and minor seconds and thirds and perfect fourths and fifths, both ascending and descending, were the only intervals employed in the Interval Series. Since the tritone is generally considered to be one of the more difficult intervals to perceive, it was excluded from linear use in the Interval Series, but did appear in the accompanying sonorities.

Atonal Sight Singing Drills

Twenty-four Atonal Sight Singing Drill units, comprised of 20 Interval Series per unit, were constructed within procedural guidelines determined by the experimenter and advisors to the study. It was decided that the experimental drill sessions would involve a slow vocal arpeggiation, in broken-chord fashion, of the pitches of a five-tone

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[1]Barnes, op. cit.

sonority of varying degrees of dissonance. These degrees of dissonance were determined using Hanson's "Six Basic Tonal Series." Each Unit of 20 Interval Series progressed from lesser to greater qualities of dissonance within each unit.[1]

The Interval Series for each unit were written first. Then the experimental variable of the accompanying sonority for each Interval Series was vertically constructed within the normal SATB range using the same Interval Series pitches. The order of difficulty of intervals resulting from Barnes' study was used in reverse order constructing the Interval Series. This was done in order to observe what effect, if any, increased drill emphasis on the more difficult intervals would be evidenced in the resulting hierarchy of intervals of this study.

The Atonal Sight Singing Drill units were constructed in the following four additive levels of interval content:

Unit Numbers	Intervals Employed
I-II	Major 3rd Down Perfect 5th Up Perfect 5th Down Perfect 4th Down Perfect 4th Up Major 2nd Down
III-VII	All of the Above Plus Minor 3rd Down Major 3rd Up

[1]Appendix B.

Unit Numbers	Intervals Employed
VIII-XVI	All of the Above Plans Minor 3rd Up Major 3rd Up
XVII-XXIV	All of the Above Plus Minor 2nd Up Minor 2nd Down

The drill sheets for the experimental group presented the Interval Series in the top of three staves with the atonal sonority notated in treble and bass clefs in the two lower staves.[1] The control group drill sheets presented only the Interval Series on a single staff.[2] The Interval Series for both groups were written twice to facilitate self-evaluation by circling incorrectly sung intervals.

The vertical sonorities accompanying the Interval Series of the experimental group's Atonal Sight Singing Drills have been generally termed as having an atonal (or non-tonal) texture. Needless to say, there are grounds for questioning some of the sonorities as actually having somewhat of a tonal center, particularly sonorities with the perfect fifth as the bottom interval. However, it was felt that the dissonant quality of the sonorities would compensate for that type of structuring (further elaboration on this point has been stated by Reti).[3]

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[1]Appendix B.

[2]Appendix C.

[3]Rudolph Reti, Tonality Atonality Pantonality (London: Barrie and Rockliff, 1958), pp. 38-41.

Tonal Sight Singing Drill Sheets

To prepare the subjects for the pre-test of singing tonally arranged Interval Series, four Tonal Sight Singing Drill units were devised within the limitations set for the Tonal Sight Singing Test.[1] Four sheets of 25 Interval Series each were constructed with graduated interval presentations of seconds and thirds, then fourths and fifths. These drill units were used in regular sight singing laboratory classes and were not tape recorded. After the completion of the Tonal Sight Singing Drills, all fall term first-year music theory students were administered the Tonal Sight Singing Test.

Tape Recording of Drill Sessions

As has been corroborated by several researchers cited in the preceding chapter, tape recorded programmed music instruction is not only a valid method of teaching certain music skills, but is also a means for controlling contaminating factors. Therefore, the drill units were recorded on magnetic tape and were administered to the subjects in a language laboratory. This environment afforded the maximum amount of uniformity in drill presentations to both the experimental and control groups within the limitations of time and availability of suitable facilities.

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[1]Appendix A, pp. 103-106.

The Atonal Sight Singing Drill units were recorded in a two-step process using stereo recording equipment. The accompanying sonorities for the Interval Series of each unit were recorded first. A Baldwin Orgasonic electric organ was used to sustain the sonority for the performance duration of the Interval Series (12 seconds per series). The clarinet stop on the "solo" rank, with no vibrato or echo, was used at "soft volume" stop setting. Pitches below the "solo" rank range were played on the pedals with a combination of flute and horn stops to balance the bass to the upper tones on the "solo" rank. A metronome equipped with a flashing light was used to insure uniformity of tempo.

The second and final step of the taping process was the recording of the Interval Series on the right stereo track while the pre-recorded accompanying sonorities were transferred from the original tape recorder to the left stereo track on the second tape recorder. The Interval Series were played on a Wurlitzer electronic piano which was directly connected to the second tape recorder.

Two model 800 Ampex stereo tape recorders were used to record the Atonal Sight Singing Drill units. The microphone used for recording the organ was a type D-20 Akustische-U. Kinogeräte Ges. M.B.H. made in Vienna, Austria. The organ sonorities were recorded at $7\frac{1}{2}$ I.P.S. They were combined on the second recorder with the electric piano at $3\frac{3}{4}$ I.P.S. to be compatible with the language laboratory equipment (DuKane language laboratory system).

Measures

Atonal Sight Singing Tests

The Atonal Sight Singing Tests were composed of the same materials as the Atonal Sight Singing Drill units. Atonal Sight Singing Test A was comprised of twelve Interval Series accompanied by atonal sonorities, matching the drill experienced by the experimental group. Atonal Sight Singing Test B contained twelve unaccompanied Interval Series, matching the drill experienced by the control group.

The Interval Series for the tests were constructed so that all intervals included in the experiment were presented four times, both ascending and descending, in each test. Three basic shapes were used in the melodic construction of the Interval Series in both tests.

1. Ascending--Descending
2. Descending--Ascending
3. Multi-Directional.

Each shape was used four times in each test to retain uniformity. Two Interval Series were deliberately constructed using consecutive fourths and one series using major thirds arranged in such a fashion as to imply a whole-tone context. These interval arrangements were conceived to observe their effects in the resulting orders of interval difficulty.

Atonal Sight Singing Test A was constructed first. The accompanying atonal sonorities were structured so that 25 of the tones were within less than an octave of the

written Interval Series, and 23 tones were an octave or more below the Interval Series allowing observation of any effects of octave displacement. As in the drill units, the accompanied Interval Series were presented in gradual order of minimum to maximum dissonance quality.[1]

Originally, Atonal Sight Singing Test B was constructed in the same manner as Test A but with Interval Series unrelated to Test A. It also contained the same equal number (4) of all included intervals. Tests A and B were tested for reliability using the test-retest method with a sample of 21 subjects. Test A displayed good reliability, but Test B did not. Consequently, a revision of Test B was constructed by inverting all but two of the Interval Series of Test A, and beginning them on appropriate pitch levels to fit the prescribed range limitations. The fourth and sixth Interval Series containing the consecutive fourths were retrogrades of those in Test A. The presentation order of the Interval Series in Test A was retained in Test B for uniformity.[2]

After revision, Atonal Sight Singing Test A displayed a reliability of .83 and Test B a reliability of .86. Internal validity was claimed for both tests due to the nature of content.

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[1]Appendix A, pp. 116-117.

[2]Appendix A, pp. 118-119.

Atonal Sight Singing Test B was of particular importance since results from that test would indicate acceptance or rejection of Hypothesis 1. The true test of the experimental drill's effectiveness was the compared performance of the experimental group with that of the control group on the test without the sonority accompaniment factor.

Tonal Sight Singing Test

The instrument of measurement for increased ability in sight singing tonally arranged intervals through practice in atonal sight singing was the Tonal Sight Singing Test.[1] This test was used both as a pre-test and post-test. Since the subjects had received tonal sight singing training during music theory coursework in the fall term, this test was designed to measure subjects' ability to sing tonally arranged Interval Series notated without a key signature.

The inclusion of all intervals to be investigated in equal numbers was unnecessary in the construction of the Tonal Sight Singing Test since the criteria for comparison was Barnes' order of difficulty of intervals.[2] However, the presentation of the Interval Series did progress from containing just seconds and thirds through gradual inclusion of fourths then fifths. The same vocal ranges, notation, clef, and number of Interval Series were used in the same manner

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[1]Appendix A, p. 107.

[2]Barnes, op. cit.

as employed in the Atonal Sight Singing Tests. The test was recorded on magnetic tape using the same procedures followed in the recording of Atonal Sight Singing Test B.

During the fall term, reliability of the Tonal Sight Singing Test was determined by administering it to 21 second-year music students at The University of Calgary. The test-retest method was used with the retest occurring after a time lapse of a week. The tests were given to groups of 5 or 6 students at a time widely dispersed in a large language laboratory. Comparison of the test scores with the retest scores using the Pearson Product-Moment Correlation indicated a high reliability of .8032.[1] Internal validity was claimed for the test in view of the nature of its content.

Design

Testing of the two main hypotheses of this study required two different experimental designs. Both designs were based on the use of an experimental group and a control group; but one hypothesis was related to an unfamiliar skill whereas the other hypothesis was related to increased performance ability of a familiar skill. Therefore, the investigation of the ability to sight sing atonally arranged series of intervals required the use of a "Posttest-Only

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[1]Appendix A, p. 120.

Control Group Design."[1] The investigation of increased ability to sight sing tonally arranged series of intervals through atonal drill called for the standard "Pretest-Posttest Control Group Design."[2]

The Atonal Sight Singing Drills were accomplished in a language laboratory. Although obviously not a completely foolproof environment, the subjects' use of headphones in partitioned stalls did aid their concentration on the tape recorded drill units. It also helped control the factor of students "cueing in" on each other's vocal responses.

A set of specific directions, occasionally repeated by the instructor, was given to the subjects which included the drill procedures to be followed by each group.[3] The experimental group proceeded in the following manner for each cell pair of Interval Series:

1. (a) The accompanying vertical sonority is sounded on the organ with the lowest tone sustained initially and the remaining four tones added at the suggested performance tempo of ♩ = 30 for each subsequent tone.
   (b) The initial tone of the Interval Series is sounded by the electric piano at the same performance tempo

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[1]Donald T. Campbell and Julian C. Stanley, Experimental and Quasi-Experimental Designs for Research (Chicago: Rand McNally & Co., 1969), pp. 25-31.

[2]Ibid., pp. 13-22.

[3]Appendix A, pp. 108-111.

while the sonority remains sustained by the organ.

2. The students vocally repeat the initial tone sounded by the electric piano and sing the remaining four pitches of the Interval Series at the suggested tempo implied by the organ ($\bigcirc$ = 30). The sonority is sustained for 12 seconds.
3. After a four-second delay, the organ sounds the sonority (all five pitches simultaneously) and the Interval Series is performed in the established tempo by the electric piano. The students are urged to vocally anticipate the piano-performed tones to check their initial accuracy and circle incorrectly performed intervals as they proceed.
4. Exact repetition of procedures in Step 1.
5. Exact repetition of procedures in Step 2.
6. Exact repetition of procedures in Step 3.

The drill procedures for the control group were similar to those of the experimental group. The only difference between the two groups were the references to the organ accompaniments. Because the organ did not set the performance tempo for the control group, the laboratory instructor verbally directed them to perform the Interval Series at a very slow tempo (approximately $\bigcirc$ = 30).

The Atonal Sight Singing Drills were conceived within the framework of the classic stimulus-response design illustrated by Figures 1 and 2.

	1. Stimuli	2. Response	3. Reinforcement and Evaluation	4. Stimuli	5. Response	6. Reinforcement and Evaluation
VISUAL	Interval Series over atonal sonority	Subjects sing Interval Series at ○ = 30	Subjects sing Interval Series anticipating playback and circle intervals performed incorrectly	Interval Series over atonal sonority	Subjects sing Interval Series at ○ = 30	Subjects sing Interval Series anticipating playback and circle intervals performed incorrectly
AURAL	Tones of sonority sounded ascending and sustained. Initial tone of Interval Series sounded.	Sonority continues to be sustained	Interval Series is played back with accompanying sonority	Tones of sonority sounded ascending and sustained. Initial tone of Interval Series sounded.	Sonority continues to be sustained	Interval Series is played back with accompanying sonority

Figure 1. Treatment design for experimental group.

	1. Stimuli	2. Response	3. Reinforcement and Evaluation	4. Stimuli	5. Response	6. Reinforcement and Evaluation
V I S U A L	Interval Series on single treble clef staff	Subjects sing Interval Series at = 30	Subjects sing Interval Series anticipating playback and circle intervals performed incorrectly	Interval Series on single treble clef staff	Subjects sing Interval Series at ○ = 30	Subjects sing Interval Series anticipating playback and circle intervals performed incorrectly
A U R A L	Initial tone of Interval Series sounded		Interval Series is played back	Initial tone of Interval Series sounded		Interval Series is played back

Figure 2. Treatment design for control group.

At the conclusion of the 24 Atonal Sight Singing Drill sessions, Atonal Sight Singing Tests A and B were administered to each subject individually. Only the instructor and the subject were present in the room which was reasonably free from outside sound. The subject and instructor were situated so that there would be no visual contact during the period of testing. The tests, which were recorded on tape, were given using high quality Koss stereo headphones which also helped control any distracting outside sounds.

The experimental group subjects were given Atonal Sight Singing Test A first, immediately followed by Test B. This was done in order to first test the subject in the environment familiar to him through the related drill experience before switching to the environment on Test B. The control group subjects were given the tests in reverse order for the same reason, performing Test B first followed by Test A. Two tape recorded versions of the tests were made--a version for each group--with the directions for taking each test.[1]

Both Atonal Sight Singing Test A and B were calibrated in the same manner as the drill units using the stimulus-response order of presentation, but eliminating its repetition. Therefore, procedures of Test A related to blocks one through three of the experimental group drill

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[1]Appendix A, pp. 112-115.

design diagram and Test B related to blocks one through three of the control group drill design (Figures 1 and 2).[1]

The Tonal Sight Singing Test, used as both pre-test and post-test, was administered to all sections of first-year music theory at the close of the fall term. The test was given individually as part of each student's final sight singing examination appointment. The same test was again individually administered as a post-test to the experimental and control group subjects at the conclusion of the 24 Atonal Sight Singing Drill sessions. The Tonal Sight Singing Test was also recorded on tape following procedures similar to those of Atonal Sight Singing Test B.

The tape recorded performances of the subjects accomplishing Atonal Sight Singing Tests A and B and the Tonal Sight Singing Tests were scored by the instructor. The resulting scores were checked for accuaracy through tape audition by two other music theory faculty members at The University of Calgary. The performance scores were based on correct or incorrect singing of the individual intervals of the Interval Series rather than performance of the Interval Series as a whole. Allowance was made for a reasonable amount of intonation variance recognizing problems of voice control in students lacking vocal experience.

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[1]Diagram, pp. 74-75.

Testable Hypotheses

This study was designed to test two primary hypotheses and also two secondary hypotheses related to atonal sight singing performance factors. To succinctly state the primary hypothesis, the training experienced by the experimental group (accompanied atonal sight singing drill) is referred to as Method I; and the training experienced by the control group (unaccompanied drill) is referred to as Method II. All of the hypotheses are stated in the following null hypothesis form:

Hypothesis 1:

> There is no difference in the ability to sight sing atonal Interval Series between students trained by Method I and Method II.

Hypothesis 2:

> Progress in ability to sight sing atonal Interval Series based on sight singing drill of atonal Interval Series will not significantly affect progress in ability to sight sing tonal Interval Series.

Of secondary interest, related to Hypothesis 1, are the following hypotheses:

Hypothesis 3:

> There is no significant difference between males and females in the ability to sight sing atonal Interval Series.

Hypothesis 4:

There is no significant difference between persons with keyboard experience and persons without keyboard experience in the ability to sight sing atonal Interval Series.

Analysis

Scores from Atonal Sight Singing Tests A and B were transferred to mark sense scoring sheets and were processed by The University of Calgary Data Center. The mean, standard deviation, variance, mean item difficulty, and item choice distributions and percentages for both tests were furnished by this process.

The resulting scores of the Atonal Sight Singing Tests were transferred to computer cards in preparation for statistical analysis by computer. A one-way design analysis of variance was used in comparing the results of the control and experimental groups on both Tests A and B. Further investigations into factors affecting atonal sight singing performance were accomplished through use of the *t* test and a two-way analysis of variance.

The resulting scores of the Tonal Sight Singing Tests were also statistically analyzed by computer using the one-way design analysis of variance.

CHAPTER IV

PRESENTATION OF THE DATA

Review of Procedure

The investigation of proficiency in sight singing series of atonally arranged intervals with accompanying sonorities constituted the main purpose of this study. Related to this was the investigation of increased ability to sight sing tonally arranged series of intervals through drill in sight singing atonally arranged intervals.

Sixty first-year music theory students participated in the experimental period which occurred during the winter term of 1971 at The University of Calgary. All sixty students had been given the Tonal Sight Singing Test as a pre-test at the close of the fall term. At the completion of the experimental drill period, the remaining 45 eligible subjects of the experimental and control groups were given Atonal Sight Singing Test A and B and the Tonal Sight Singing Test (post-test).

The resulting test scores were recorded on computer cards and prepared for processing at the Data Center of The University of Calgary. A one-way analysis of variance was used to determine the acceptance or rejection of the two

primary hypotheses. Closer inspection of the factors of keyboard experience and sex was accomplished using a two-way analysis of variance of fixed factors and a small sample t test on resulting test data.

Hypotheses

Hypothesis 1

> There is no difference in the ability to sight sing atonal Interval Series between students trained by Method I and Method II.[1]

The obtained F values for both Atonal Sight Singing Tests A and B indicated acceptance of the null hypothesis. The results are shown in Tables 1 and 2.

TABLE 1

ANALYSIS OF VARIANCE SUMMARY BETWEEN THE EXPERIMENTAL GROUP AND CONTROL GROUP ON ATONAL SIGHT SINGING TEST A

Source	SS	df	MS	F
Between groups	22.33	1	22.33	0.51
Within groups	1899.32	43	44.17	
Totals	1921.65	44		

[1]See "Testable Hypotheses," p. 78.

TABLE 2

ANALYSIS OF VARIANCE SUMMARY BETWEEN THE EXPERIMENTAL GROUP AND CONTROL GROUP ON ATONAL SIGHT SINGING TEST B

Source	SS	df	MS	F
Between groups	163.59	1	163.59	3.02
Within groups	2332.18	43	54.24	
Totals	2495.77	44		

Hypothesis 2

> Progress in ability to sight sing atonal Interval Series based on sight singing drill of Atonal Interval Series will not significantly affect progress in ability to sight sing tonal Interval Series.

The F values indicate rejection of the null hypothesis for both the experimental group and the control group. The results are shown in Tables 3 and 4.

TABLE 3

ANALYSIS OF VARIANCE SUMMARY BETWEEN THE TONAL SIGHT SINGING TESTS (PRE-TEST AND POST-TEST) OF THE EXPERIMENTAL GROUP

Source	SS	df	MS	F
Between groups	491.11	1	491.11	9.93*
Within groups	2076.77	42	49.45	
Totals	2567.88	43		

*Significant at the .01 level of confidence.

TABLE 4

ANALYSIS OF VARIANCE SUMMARY BETWEEN THE ATONAL SIGHT SINGING TESTS (PRE-TEST AND POST-TEST) OF THE CONTROL GROUP

Source	SS	df	MS	F
Between groups	515.56	1	515.56	13.49*
Within groups	1681.39	44	38.21	
Totals	2196.95	45		

*Significant at the .01 level of confidence.

A t test was used to determine the possible existence of any significant difference between experimental and control group progress in the ability to sight sing tonal Interval Series. The obtained t value of .289 indicated no such difference existed.

Hypothesis 3

> There is no significant difference between males and females in the ability to sight sing atonal Interval Series.

A t test for small samples of subjects was used to determine whether or not there existed a significant difference in performance scores on Atonal Sight Singing Tests A and B between males and females of both groups.[1] Visual inspection of the data indicated that analysis of variance

[1]Appendix A, pp. 132-133.

would show little difference between males and females; therefore, this procedure was omitted. The null hypothesis was accepted as shown in Table 5.

TABLE 5

SUMMARY OF t TEST VALUES BETWEEN PERFORMANCE SCORES OF MALES AND FEMALES IN BOTH STUDY GROUPS ON ATONAL SIGHT SINGING TESTS A AND B

Group & Factor	vs.	Group & Factor	Test A	Test B
Exp. Male		Exp. Female	t = .421	t = .210
Exp. Male		Con. Female	t = .278	t = .991
Con. Male		Con. Female	t = .278	t = .281
Con. Male		Exp. Female	t = .554	t = 1.220
Exp. Male		Con. Male	t = .018	t = .743
Exp. Female		Con. Female	t = .866	t = 1.570

Hypothesis 4

> There is no significant difference between persons with keyboard experience and persons without keyboard experience in the ability to sight sing atonal Interval Series.

A fixed factor analysis of variance was performed on the resulting scores of experimental and control group subjects with and without keyboard experience on Atonal Sight Singing Test B. The Atonal Sight Singing Tests were designed so that the comparative results of the experimental and control groups on Test B would indicate the effectiveness

of the experimental drill treatment. The F values obtained were not sufficiently high enough to be considered significant and therefore indicated acceptance of the null hypothesis. However, the F value indicating interaction reached near significance at .05 ($p < .07$) and called for further inspection of test results as shown in Table 6.

TABLE 6

SUMMARY OF ANALYSIS OF VARIANCE OF FIXED FACTORS BETWEEN RESULTING SCORES OF SUBJECTS WITH AND WITHOUT KEYBOARD EXPERIENCE ON ATONAL SIGHT SINGING TEST B

Source	SS	df	MS	F
Keyboard factor	2.35	1	2.35	.04
Group factor	159.71	1	159.71	3.03
Interaction	213.48	1	213.48	4.05
Within	2160.77	41	52.70	

A *t* test for small samples of subjects was used to determine whether or not there existed a significant difference in resulting scores of Atonal Sight Singing Tests A and B between experimental and control group subjects with and without keyboard experience.[1] The obtained *t* values from the compared results of experimental and control group subjects with keyboard experience determined the sources

[1]Appendix A, pp. 134-135.

of interaction indicated by the analysis of variance. A summary of those particular t tests are shown in Table 7.

TABLE 7

SUMMARY OF t TEST DATA BETWEEN RESULTING SCORES OF SUBJECTS WITH KEYBOARD EXPERIENCE ON ATONAL SIGHT SINGING TESTS A AND B

Group & Factor	Mean	S.D.	df	t	Test
Exp. Keybd.	39.08	6.60			
Con. Keybd.	33.09	4.82	22	2.38*	A
Exp. Keybd.	38.15	6.45			
Con. Keybd.	30.27	6.83	22	2.80**	B

*Significant at .05 level of confidence.

**Significant at .02 level of confidence.

The obtained t value from the compared scores of control group subjects with and without keyboard experience on Test A also proved to be significant at the .05 level of confidence as shown in Table 8.

TABLE 8

SUMMARY OF t TEST DATA BETWEEN RESULTING SCORES OF CONTROL GROUP SUBJECTS WITH AND WITHOUT KEYBOARD EXPERIENCE ON ATONAL SIGHT SINGING TEST A

Group & Factor	Mean	S.D.	df	t	Test
Con. Keybd.	33.09	4.82			
Con. No Keybd.	38.67	5.47	21	2.49*	A

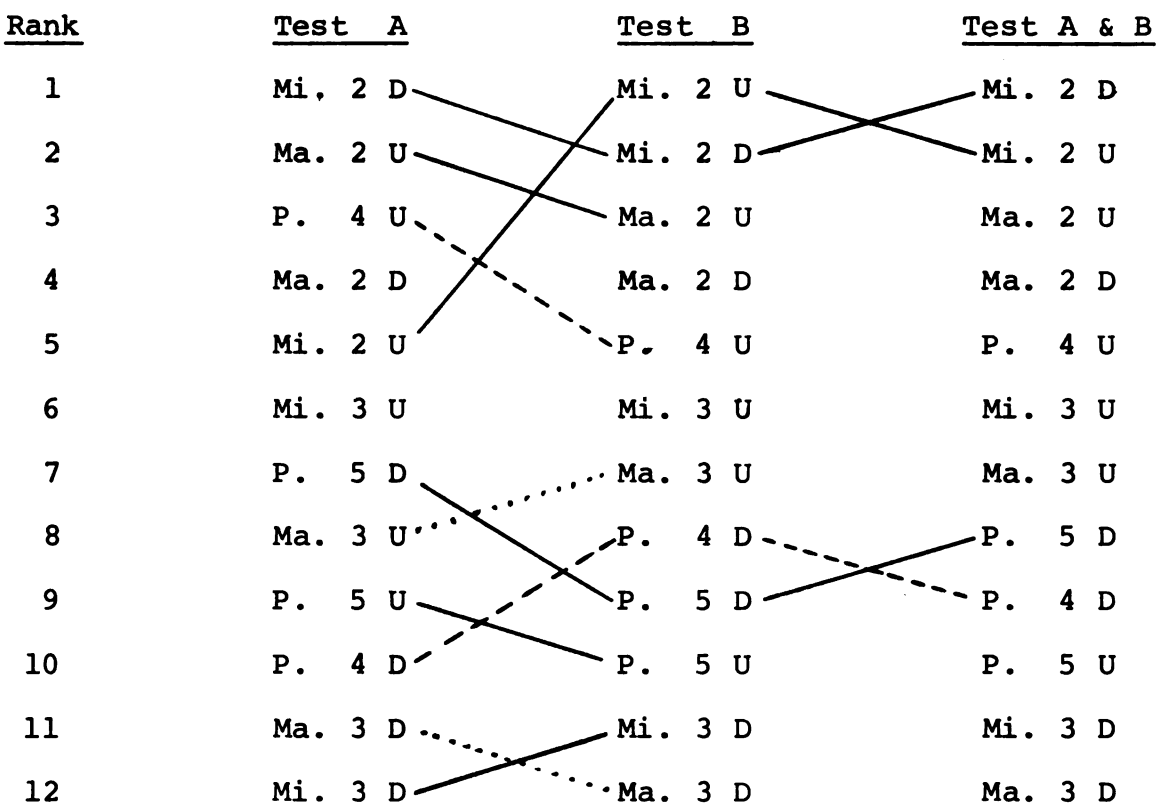
*Significant at .05 level of confidence.

Related Data

The Atonal Sight Singing Tests were devised so that all intervals, both ascending and descending, included in the limitations of this study would be presented in equal numbers to render tables of interval hierarchy.[1] Figure 3 contains the orders of interval difficulty for each test and the combined hierarchy of both tests. The interval position changes from one test to another are also diagrammed.

Atonal Sight Singing Test A was constructed so that accompanying sonority pitches would be approximately evenly divided between pitches within an octave (25) of the Interval Series and pitches an octave or more below (23) the Interval Series. Table 8 shows the resulting averages of correctly sung interval pitches displaced within the sonority an octave or more below the Interval Series.

[1]Appendix A, p. 136.



——— indicates general movement.

···· indicates movement possibly related to whole-tone arr.

---- indicates movement possibly related to consecutive fourth arr.

D indicates downward direction of interval.

U indicates upward direction of interval.

Figure 3. Hierarchy of intervals resulting from both groups' performance of Atonal Sight Singing Tests A and B. (Interval rank order from least to most difficult.)

The summary also shows the resulting percentages of male and female subjects of both groups.

TABLE 9

SUMMARY OF CORRECTLY SUNG INTERVAL PITCH AVERAGES OF MALE AND FEMALE SUBJECTS OF BOTH GROUPS ON ATONAL SIGHT SINGING TEST A

Group	Sex	Number of Subjects	Correct Interval Average[a]
Experimental	Male	8	17.37
Experimental	Female	14	17.07
Experimental	Both	22	17.18
Control	Male	9	16.88
Control	Female	14	16.57
Control	Both	23	16.69
Both	Both	45	16.93

[a]Average of correctly sung interval pitches 8va or more below Interval Series pitch.

The results indicated that octave displacement of tones within the sonority made no significant difference between males and females nor between groups.

CHAPTER V

SUMMARY AND CONCLUSIONS

Summary

The primary purpose of this study was the investigation of proficiency in sight singing series of atonally arranged intervals accompanied by atonal sonorities. An additional related investigation of increased ability to sight sing tonally arranged intervals through atonal sight singing drill was also performed as part of the experiment.

Sixty first-year music theory students at The University of Calgary participated in this experiment during the winter term of 1971. The students had been given the Tonal Sight Singing Test, used as a pre-test and post-test, as part of the final sight singing examination of the fall term.

Twenty-four Atonal Sight Singing Drill units were administered to two music theory laboratory class sections randomly designated as experimental and control groups. The drills were tape recorded and the drill sessions took place in a large language laboratory. At the completion of the 24 drills, the remaining 22 experimental subjects and 23 control subjects who had experienced all 24 drills were given

Atonal Sight Singing Tests A and B and the Tonal Sight Singing Test (post-test).

Atonal Sight Singing Test A corresponded in nature of content and presentation to the Atonal Sight Singing Drills given to the experimental group. It contained twelve atonal Interval Series presented over sustained sonorities comprised of vertical arrangements of the Interval Series pitches. Atonal Sight Singing Test B corresponded to the Atonal Sight Singing Drills given to the control group. It, like Test A, contained twelve atonal Interval Series but without sonority accompaniment.

Each subject taking the Atonal Sight Singing Tests was first given the test that corresponded to his drill experience followed immediately by the remaining test. The tests, pre-recorded on tape, were given to each subject individually with the performances recorded on a second tape recorder for later evaluation.

The Tonal Sight Singing Test, which had been given as a pre-test, was given individually to subjects of both groups as a post-test. It was administered in the same manner as the Atonal Sight Singing Tests. Its content was similar to Atonal Sight Singing Test B except that the Interval Series were tonal.

Conclusions

Two main hypotheses and two secondary hypotheses, stated in null form, were tested for statistical

significance producing the following research results and conclusions:

Hypothesis 1

> There is no difference in the ability to sight sing atonal Interval Series between students trained by Method I and Method II.[1] Accepted.

Atonally accompanied sight singing drill does not significantly increase the subject's ability to sight sing atonal Interval Series over that of subjects drilled in unaccompanied atonal sight singing.

Hypothesis 2

> Progress in ability to sight sing atonal Interval Series based on sight singing drill of atonal Interval Series will not significantly affect progress in ability to sight sing tonal Interval Series. Rejected.

Sight singing drill of atonal Interval Series will significantly increase the subject's ability to sight sing tonal Interval Series.

Hypothesis 3

> There is no significant difference between males and females in the ability to sight sing atonal Interval Series. Accepted.

Sex makes no difference in a subject's ability to sight sing tonal Interval Series.

Hypothesis 4

> There is no significant difference between persons with keyboard experience and persons without keyboard experience in the ability to sight sing atonal Interval Series. Accepted.

---

[1]See "Testable Hypotheses," p. 78.

Subjects with keyboard experience display no greater ability in sight singing atonal Interval Series than do subjects without keyboard experience.

Discussion

The main hypothesis and instrumentation of this experiment were based on the assumption that unaccompanied drill in atonal sight singing is superior to accompanied drill in teaching the skill of atonal sight singing. Although resulting data of this experiment indicated acceptance of that hypothesis, the F value yielded by the analysis of variance on Atonal Sight Singing Test B implies that accompanied atonal sight singing drill, although not more effective, is as effective a method of drill as is unaccompanied drill.

The increase of scores on Atonal Sight Singing Test A over scores on Test B by the control group subjects was an additional implication of the effectiveness of accompanied atonal sight singing drill. Eighteen of the twenty-three control group subjects scored higher on Test A than on Test B. Only five of the twenty-two experimental group subjects registered a drop in score from Test A to Test B. Although Tests A and B were environmentally different, the similarity and uniformity of interval presentation between the tests might justify such a comparison.

Confusion, resulting from the change of context from that to which the subject was accustomed in the drills to

that of the opposite group, was evidenced in the subjects' performances on the Atonal Sight Singing Tests. This effect was particularly noted in performances by control group subjects in the initial Interval Series on Test A.

The secondary investigations related to Hypotheses 3 and 4 compared scores of experimental and control group subjects categorized according to the investigated factors. The sex factor was investigated mainly from the standpoint of possible performance differences between males and females relative to octave displacement in the accompanying sonorities of Atonal Sight Singing Test A. Neither the sex factor nor octave displacement displayed any notable effect on the results. However, keyboard experience proved to be a significant factor in this group of subjects.

The high F value indicating interaction in the analysis of variance of fixed factors performed on scores of subjects with and without keyboard experience called for further statistical investigation. A t test for small samples of subjects was used to compare mean scores within and between both study groups with and without keyboard experience. The t values shown in Table 7 attest to the significant performance of experimental group subjects over control group subjects, both with keyboard experience, on Atonal Sight Singing Test A and B. However, the t value shown in Table 8 indicated that the control group subjects without keyboard experience performed significantly better

than the control group subjects with keyboard experience thus exposing the source of the indicated interaction.

The factor of singing experience was also considered for statistical comparison; but it was found that virtually the same subjects with keyboard experience were also those with prior vocal experience. Consequently, further investigation of the vocal experience factor was unnecessary.

The hierarchy of intervals resulting from the Atonal Sight Singing Tests displayed rankings which may have been influenced by the experimental treatment. The deliberate use of consecutive fourths in the same direction, in Interval Series four and six of both tests, seemed to influence their changes of position from Test A to Test B. The perfect fourth upwards in Test A was sung correctly 84 percent of the time; but with the sonority removed in Test B, it was sung correctly only 75 percent of the time moving it from third to fifth (less to more difficult) position. The perfect fourth downward, shown to be more difficult, moved from tenth position in Test A to eighth position in Test B, but its percentage remained basically the same (approximately 66 percent correctly sung).

The whole-tone arrangement of major thirds, which occurred only in the eleventh Interval Series on both tests, did not seem to display major position changes. However, the major third down, sung correctly 64.5 percent on Test A,

moved from eleventh position to the most difficult interval position (twelfth) on Test B with 52.25 percent.

A general comparison of the hierarchy of intervals of this study with that obtained by Barnes shows that the interval rankings are quite similar with the exception of the minor third downward. This interval consistently retained its position as being quite difficult in both tests, whereas Barnes' findings rank it in the lower half among the less difficult intervals. This might be indicative of its use in an atonal melodic arrangement as compared with its frequent triadic use in tonal melodic arrangements. Such questions emphasize the need for further research comparing influences of tonal and atonal contexts on melodic material.

An observation that seemed to favor the experimental treatment was the greater attention span of the experimental group than that of the control group during the Atonal Sight Singing Drills. An obvious reason for this was the novelty of fitting the Interval Series pitches into the sustained sonority. The control group, lacking the sonority factor, was left to its own devices for singing the Interval Series other than suggestions included in the directions for drill.

The Tonal Sight Singing Test as well as the Tonal Sight Singing Drills emphasized the key signature factor in sight singing performance. The traditional conditioning of musicians emphasizes reliance upon knowledge of the tonal center through use of the key signature. When this factor is removed from music and only accidentals indicating pitch

inflection are used before appropriate notes, determination of the tonal center becomes much more difficult for persons so conditioned. The rejection of Hypothesis 2 indicates that either method of atonal sight singing drill used in this study is a valid aid toward increased ability to sight sing tonal music without key signatures.

Suggestions for Future Research

1. A replication of this study with modification of the Interval Series and inclusion of all intervals within an octave might produce additional useful information regarding Hypothesis 1.

2. A study similar to this design but using tonal sonorities and Interval Series would further investigate the factor of tonal center determination related to key signature in sight singing.

3. Experimental testing of large populations in sight singing atonal melodies with atonal accompaniments containing melodic line pitches compared with atonal accompaniments not containing melodic line pitches would investigate the affective nature of such sonorities.

The general lack of research in atonal musical practices leading to innovative pedagogical approaches substantiates the need for such research. Such experimental research can lead to more effective teaching of the skills which aid in the performance, analysis, and understanding of twentieth century music.

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APPENDIX A

TEST AND DRILL MATERIALS AND RAW DATA

ATONAL SIGHT SINGING EXPERIMENT

SUBJECT QUESTIONNAIRE

Name _____ Sex (male)(female)

University year level _____ Class (9:00)(10:00)(12:00)

Performance major _____ Years of study _____

ARCT or Western Regional grade level _____

Performance minor _____ Years of study _____

ARCT or Western Regional grade level _____

Keyboard experience (other than above); if so, years of study _____

Formal ear training or sight singing experience before university level? If so, explain briefly the situation in which you received such experience.

Subject's signature _____

DRILL SESSION ATTENDANCE RECORD

UNITS: I II III IV V VI VII VIII IX X XI XII

XIII XIV XV XVI XVII XVIII XIX XX XXI XXII

XXIII XXIV (circled units indicate absences)

TEST RESULTS

ATONAL SIGHT SINGING TEST A Score: _____

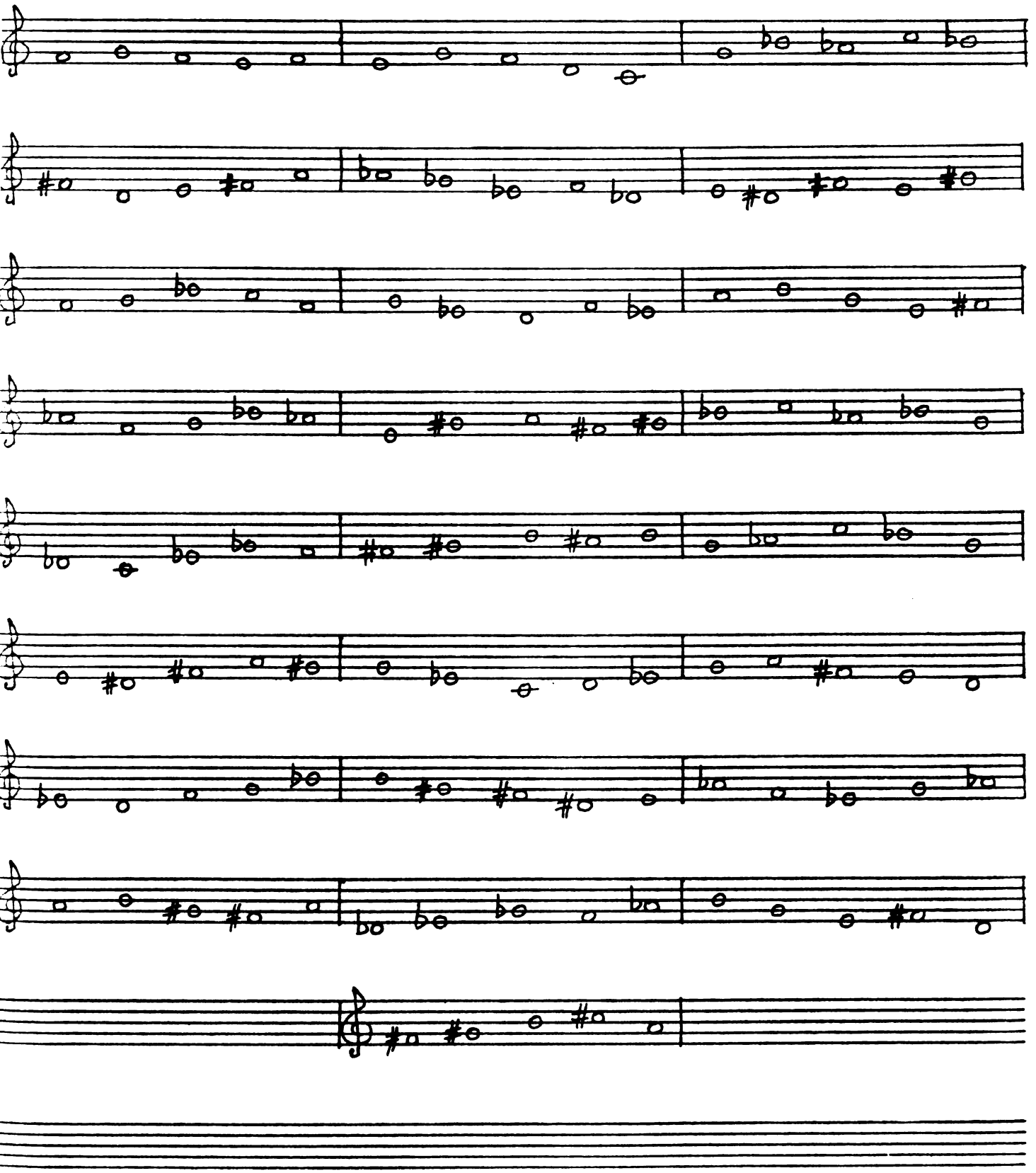
ATONAL SIGHT SINGING TEST B Score: _____

TONAL SIGHT SINGING TEST A Score: _____

TONAL SIGHT SINGING TEST B Score: _____

TONAL SIGHT SINGING DRILLS

SHEET I



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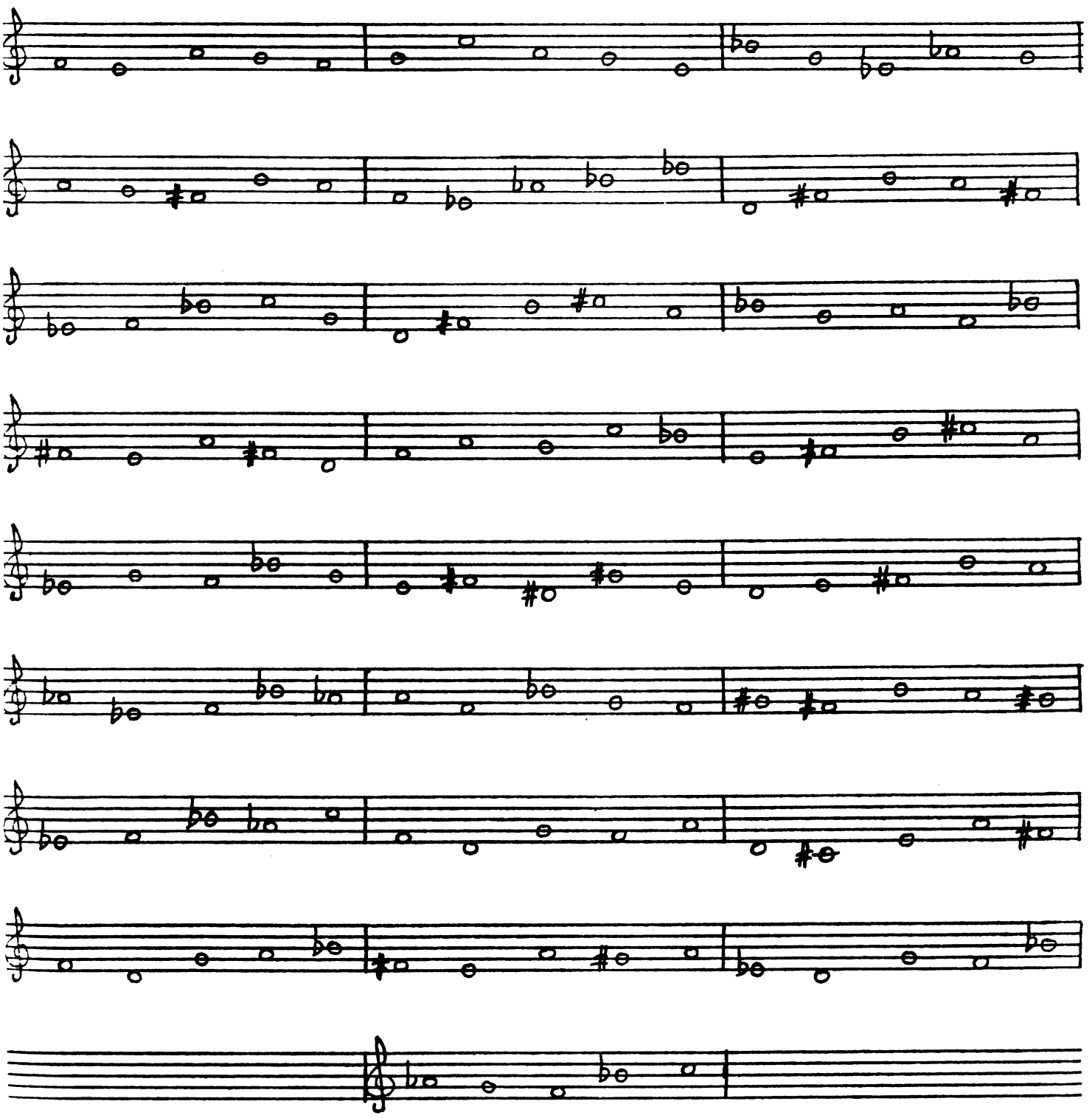

TONAL SIGHT SINGING DRILLS

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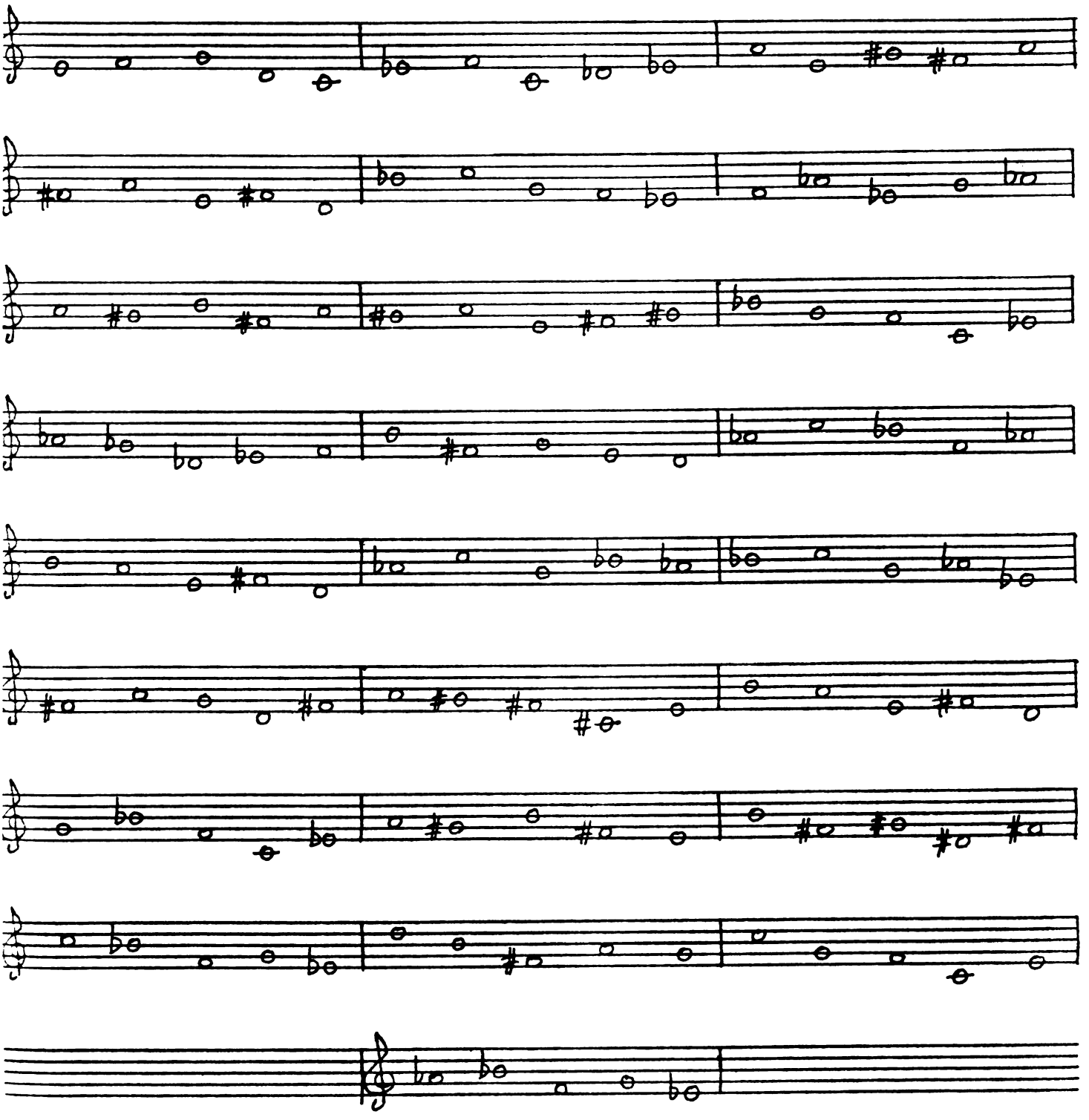

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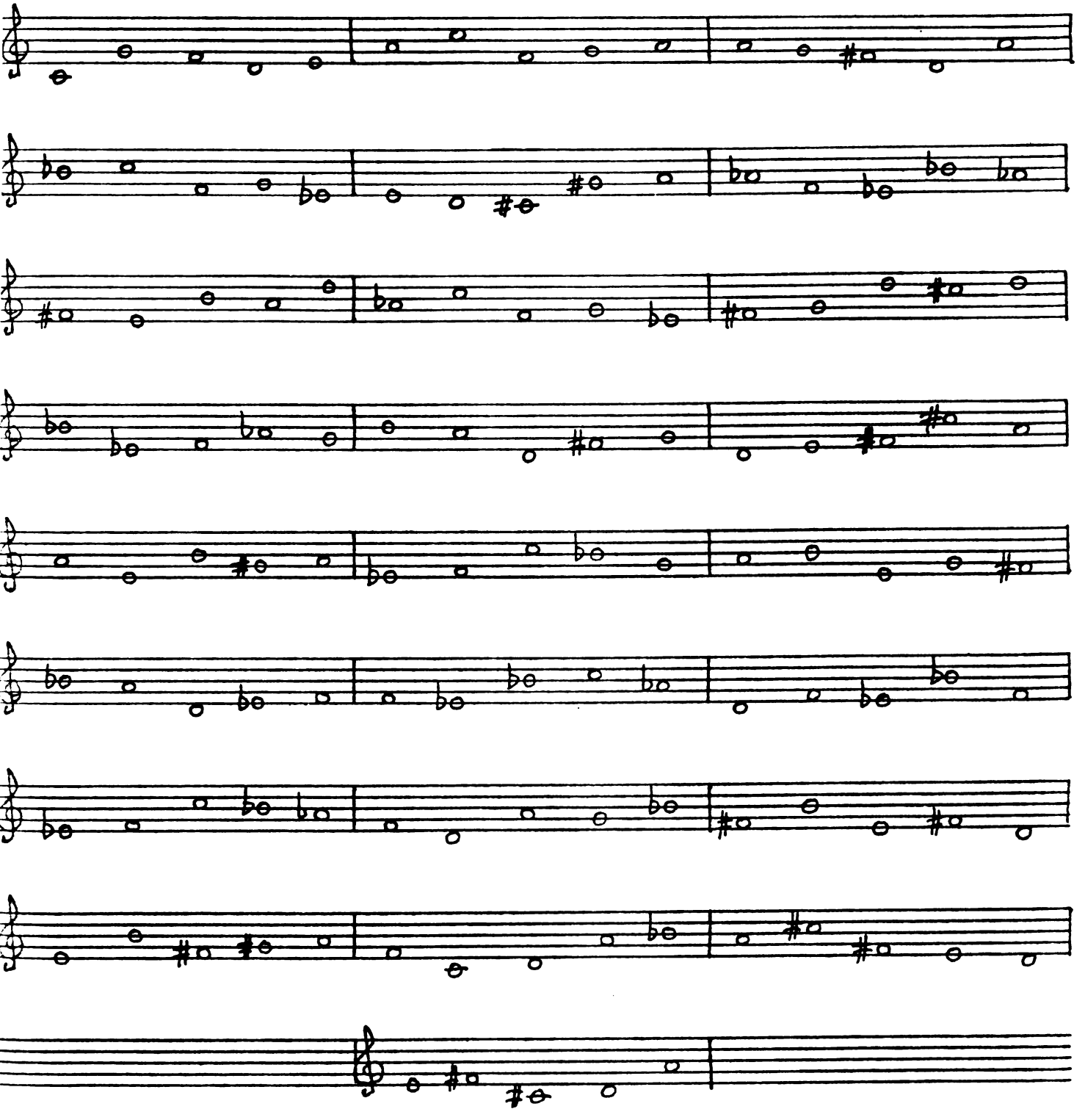
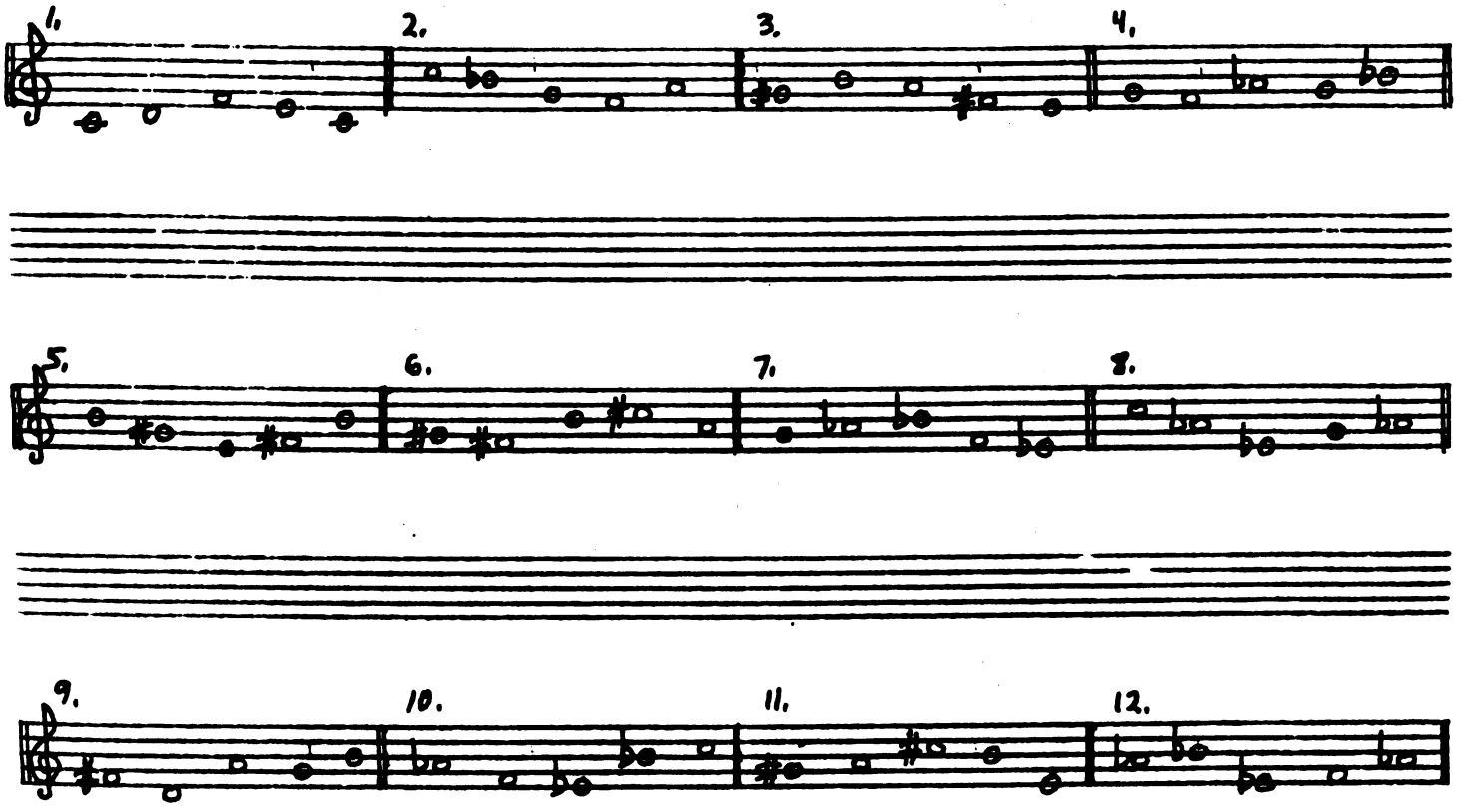


TONAL SIGHT SINGING TEST

Name



ATONAL SIGHT SINGING DRILLS

DIRECTIONS FOR EXPERIMENTAL SUBJECTS

Drill sheets with 20 cells of atonal Interval Series will be distributed to you at the beginning of each laboratory drill session. Sign your name and today's date at the top of the first page.

Put on your headsets and adjust them so that they comfortably fit your ears. Adjust the knob labeled "program" to hear the recorded drills. No other controls require any adjustment.

Each Interval Series to be sung is presented twice within each cell. The Interval Series are written in whole-note notation, without key signatures, and appear on the top staff of each cell. The bottom two staves contain the same pitches as are in the Interval Series but arranged in a vertical sonority.

An electric organ will sound the individual pitches of the accompanying sonority, beginning with the lowest pitch, and will sustain them as they are sounded. Then an electric piano will sound the first pitch of the Interval Series to be sung. You will sing that same pitch and then proceed through the remaining four pitches of the series. The approximate tempo at which you should sing is that at which the pitches were individually sounded ($\bigcirc$ = 30). Once you have begun, go completely through the five pitches

without repeating notes. As you sing, try to blend each pitch into the sustained sonority.

After a slight pause, the sonority will be sounded by the organ and the electric piano will play (correctly) the Interval Series back to you at the previous tempo. As the notes are played, sing with the piano, vocally anticipating each note, and circle the intervals (pairs of pitches) on which you errored.

The same drill sequence will again occur and you will vocally respond in the same manner. Try to keep in mind the intervals incorrectly sung on the first performance while accomplishing the second.

Do not sing openly--hum! Headsets restrict your hearing openly through the ears. The tones you will hear are transmitted by the skull bones. Therefore, little is gained from singing loudly which will distract others.

Remember to sing very slowly and try to blend your sung pitches into the sustained sonority. Leave all drill sheets in your booth at the conclusion of the drills and be certain you have signed your name and today's date.

ATONAL SIGHT SINGING DRILLS

DIRECTIONS FOR CONTROL SUBJECTS

A drill sheet with 20 cells of atonal Interval Series will be distributed to you at the beginning of each laboratory drill session. Sign your name and today's date at the top of the sheet.

Put on your headsets and adjust them so that they comfortably fit your ears. Adjust the knob labeled "program" to hear the recorded drills. No other controls require any adjustment.

Each Interval Series to be sung is presented twice within each cell. The Interval Series are written in whole-note notation and without key signatures.

An electric piano will sound the first pitch of the Interval Series to be sung. You will sing that same pitch and then proceed very slowly through the remaining four pitches of the series at approximately $\mathcal{O}$ = 30. Once you have begun, go completely through the five pitches without repeating notes. To determine each interval, use previously instructed techniques such as numbers or solfege; refrain from singing wide intervals in steps and half-steps.

After a slight pause, the electric piano will play (correctly) the Interval Series back to you at the approximate tempo at which you should sing ($\mathcal{O}$ = 30). As the notes are played, sing with the piano, vocally anticipating

each note, and cirlce the intervals (pairs of pitches) on which you errored.

The same drill sequence will again occur and you will vocally respond in the same manner. Try to keep in mind the intervals incorrectly sung on the first performance while accomplishing the second.

Do not sing openly--hum! Headsets restrict your hearing openly through the ears. The tones you will hear are transmitted by the skull bones. Therefore, little is gained from singing loudly which will distract others.

Remember to sing very slowly and accurately. Leave your drill sheet in your booth at the conclusion of the drills and be certain you have signed your name and today's date.

ATONAL SIGHT SINGING TESTS

(TAPE RECORDED DIRECTIONS FOR EXPERIMENTAL GROUP SUBJECTS)

This final test in atonal sight singing is in two parts labeled A and B. In Test A, which you will experience first, you are to proceed just as you have been doing in the drill units with the exception that you will only give one response of the five tones to the given pitch. The Interval Series will be played back to you in its correct form and you may vocally anticipate the notes as you did in the drills; but then you will proceed directly to the next row executing it in the same manner.

Remember to sing very slowly taking time to accurately recognize each interval and blend it into the background sonority as well as you can. Do not back up, repeat, or vocally test between the notes of the intervals. Once you start each row go completely through to the last note, but remember to do so slowly and methodically.

Directions for Test B will follow Test A. Please state your name.

(TEST A)

Atonal Sight Singing Test B will be accomplished in the same manner as Test A but with one difference: there will be no accompanying sonority on the organ. The beginning tone will be sounded by the electric piano which you

will repeat and then slowly proceed through the remaining tones. As before, go completely through the five tones without repetition or testing of intervals.

(TEST B)

ATONAL SIGHT SINGING TESTS

(TAPE RECORDED DIRECTIONS FOR CONTROL GROUP SUBJECTS)

This final test in atonal sight singing is in two parts labeled A and B. You will be administered Test B first in which you are to proceed just as you have been doing in the drill units, with the exception that you will give only one response of the five tones to the given pitch. The Interval Series will be played back to you in its correct form and you may vocally anticipate the notes as you did in the drills; but then you will proceed directly to the next row executing it in the same manner.

Remember to sing very slowly taking time to accurately recognize each interval. Do not back up, repeat, or vocally test between the notes of the intervals. Once you start each row, go completely through to the last note, but remember to do so slowly and methodically.

Directions for Test A will follow Test B. Please state your name.

(TEST B)

Atonal Sight Singing Test A will be accomplished in the same manner as Test B with one difference: there will be an organ sustaining an accompanying chord which will be composed of the same five tones you will sing. As you sing the tones, try as best you can to blend them within the

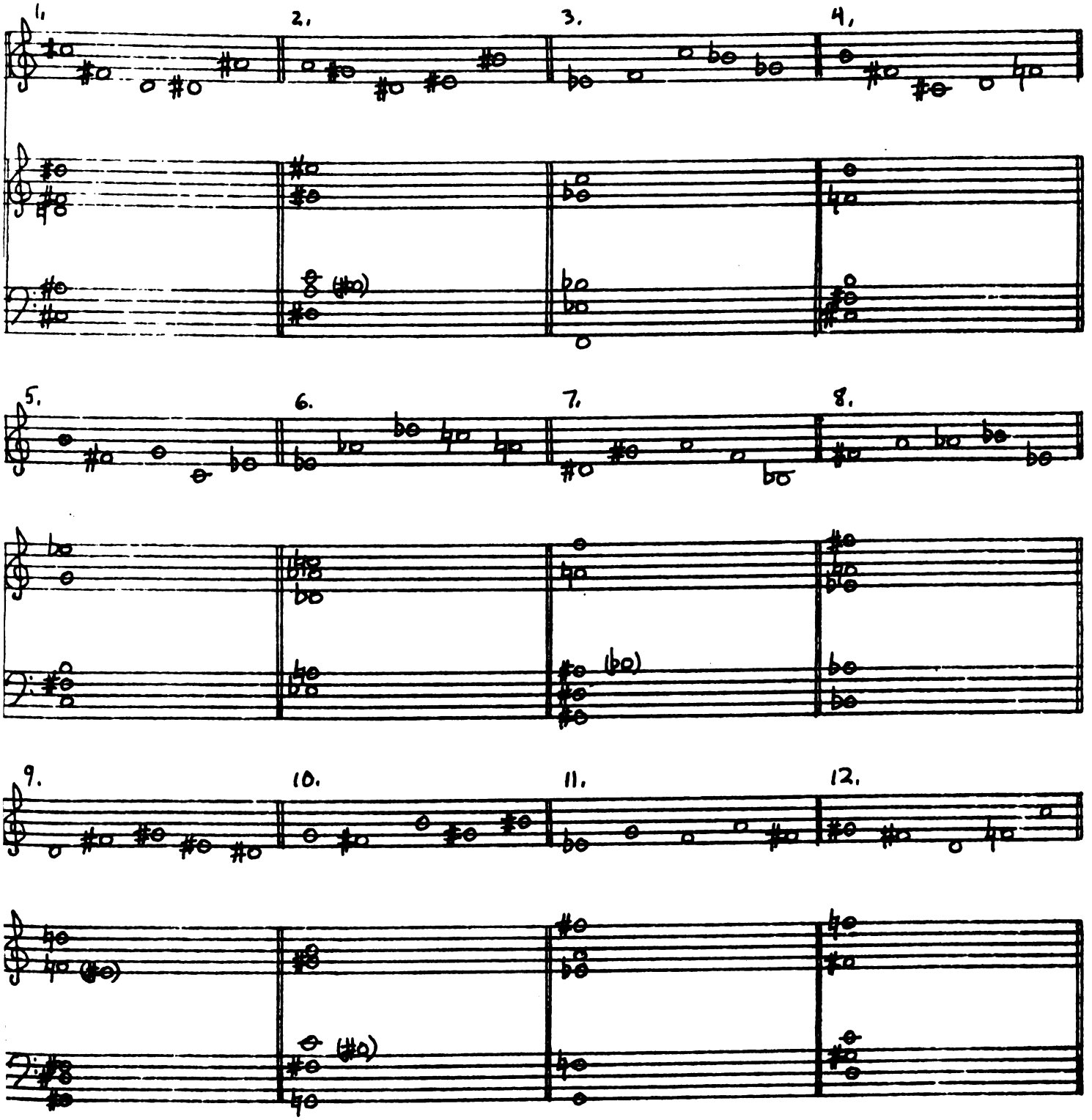
chord. The organ will arpeggiate the chord from the lowest note upwards in approximately the same tempo in which you should respond. Then the first tone of the Interval Series will be sounded by the electric piano and you will proceed as usual singing the five tones. The tones will be played back to you in their correct form with the organ accompaniment. As before, go completely through the five tones without repetition or testing of intervals.

(TEST A)

ATONAL SIGHT SINGING TEST

A

Name



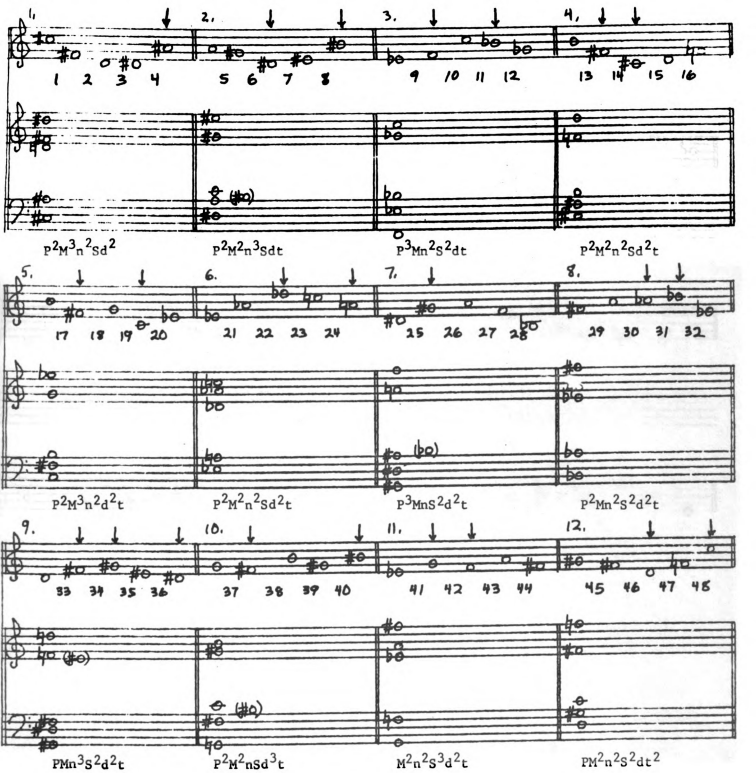
ATONAL SIGHT SINGING TEST

A

Name

OCTAVE DISPLACEMENT, INTERVAL DESIGNATION AND SONORITY ANALYSIS

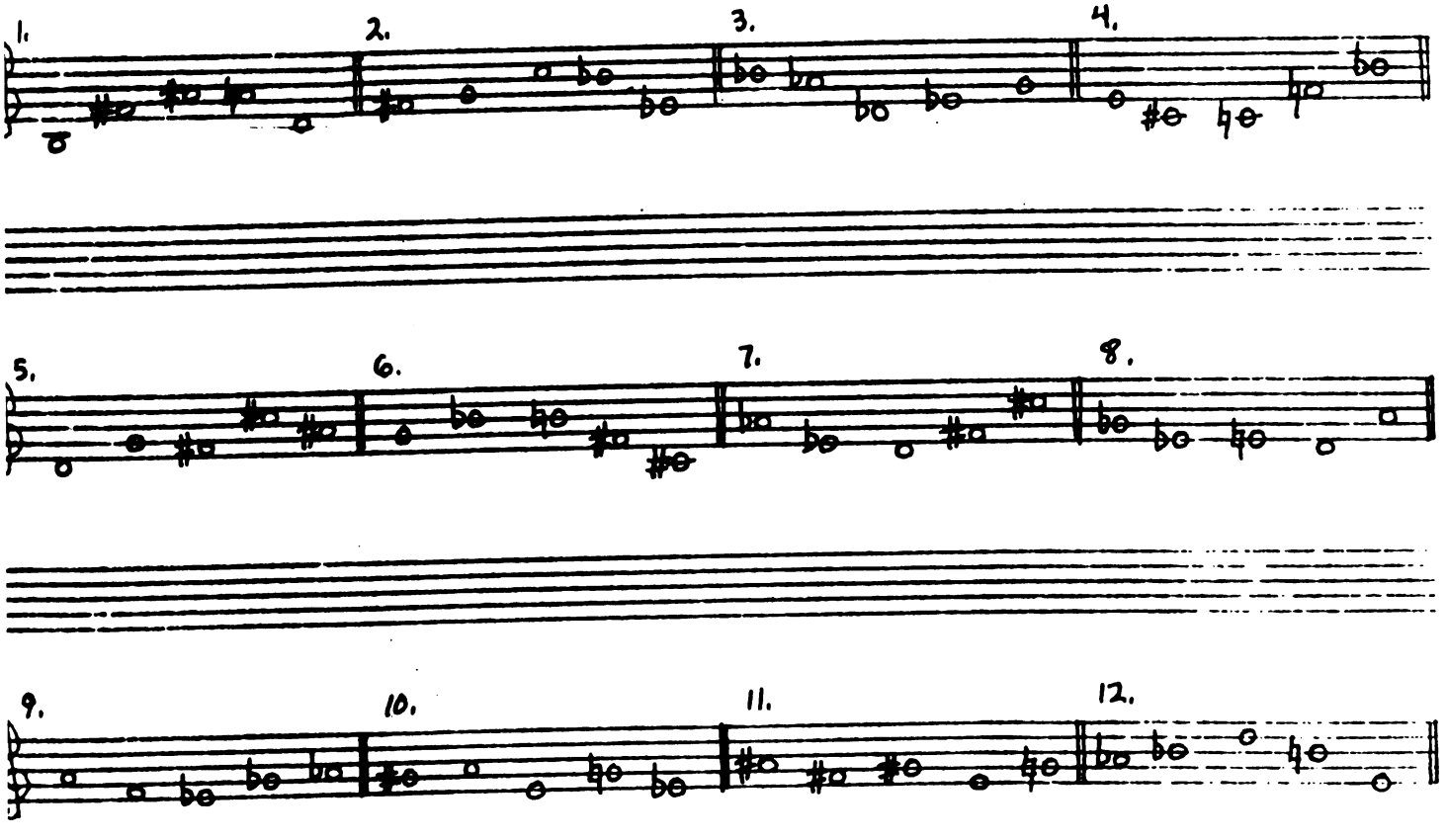
Arrows indicate octave displacement (23 pitches) in relation to male voice range.



ATONAL SIGHT SINGING TEST

B

Name



ATONAL SIGHT SINGING TEST

B

Name INTERVAL DESIGNATION

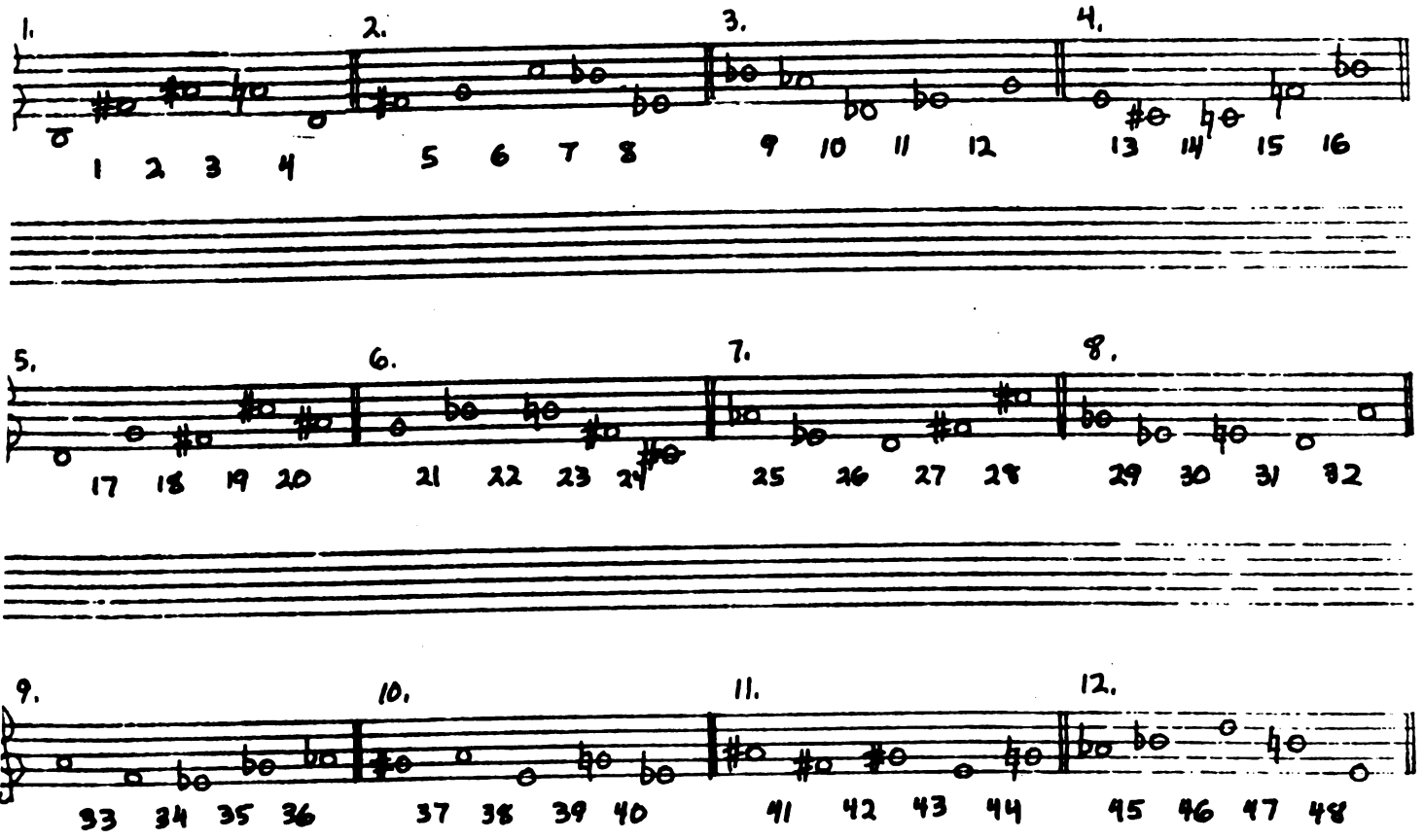


TABLE 10

RELIABILITY OF TONAL SIGHT SINGING TEST AS DETERMINED BY THE TEST-RETEST METHOD[a]

Subject	Test	Retest
L.B.	26	28
D.C.	35	37
J.C.	41	42
A.D.	22	21
P.E.	22	23
L.F.	44	45
S.F.	31	32
B.G.	38	40
C.H.	28	29
M.J.	32	33
B.K.	30	30
R.N.	24	26
B.P.	33	35
O.R.	25	24
A.S.	42	41
G.S.	39	39
T.S.	25	27
L.T.	23	25
R.T.	36	38
B.W.	35	34
N.W.	32	34

[a]Score = number correctly sung of 48 intervals; Test-Retest reliability = .8032 (Pearson Product-Moment).

TABLE 11

RAW SCORES: TONAL SIGHT SINGING TEST

Experimental Group			Control Group		
Subjects	Pretest	Posttest	Subjects	Pretest	Posttest
			B.A.	37	43
K.B.	35	45	A.B.	28	38
M.B.	23	36	D.B.	36	41
V.B.	24	28	J.B.	30	34
L.D.	34	39	I.C.	39	46
J.E.	27	36	J.C.	39	47
J.F.	32	41	O.C.	29	37
D.G.	30	40	D.E.	29	36
P.H.	39	41	E.F.	29	36
N.K.	38	44	P.F.	19	26
T.L.	38	43	S.H.	27	37
B.M.	25	26	E.J.	41	45
E.M.	22	31	B.L.	40	45
S.M.	31	45	D.M.	19	28
L.P.	18	28	N.M.	38	42
D.R.	43	47	T.M.	30	35
P.R.	37	39	M.P.	36	42
R. Su.	42	46	B.R.	29	35
B.V.	26	35	E.R.	33	42
C.W.	38	44	G.S.	32	41
K.W.	40	47	V.S.	34	39
S.W.	44	47	R.Sc.	23	29
M.Y.	36	41	R.M.T.	40	47
Number of Subjects	22	22		23	23
Mean	32.82	39.50		32.04	38.74
Standard Deviation	7.50	6.53		6.43	5.93

TABLE 12

ATONAL SIGHT SINGING TEST A RAW SCORES

Experimental Group		Control Group	
Subjects	Scores	Subjects	Scores
		B.A.	40
K.B.	33	A.B.	32
M.B.	30	D.B.	39
V.B.	29	J.B.	32
L.D.	45	I.C.	40
J.E.	29	J.C.	44
J.F.	34	O.C.	28
D.G.	27	D.E.	36
P.H.	43	E.F.	30
N.K.	43	P.F.	28
T.L.	43	S.H.	33
B.M.	31	E.J.	45
E.M.	30	B.L.	47
S.M.	40	D.M.	30
L.P.	28	N.M.	43
D.R.	47	T.M.	39
P.R.	43	M.P.	38
R.Su.	41	B.R.	28
B.V.	31	E.R.	37
C.W.	44	G.S.	30
K.W.	44	V.S.	33
S.W.	48	R.Sc.	30
M.Y.	40	R.M.T.	43
Number of Subjects	22		23
Mean	37.41		36.00
Standard Deviation	7.11		6.17

TABLE 13

RAW SCORES: ATONAL SIGHT SINGING TEST B

Experimental Group		Control Group	
Subjects	Scores	Subjects	Scores
		B.A.	40
K.B.	32	A.B.	30
M.B.	30	D.B.	40
V.B.	29	J.B.	31
L.D.	43	I.C.	40
J.E.	29	J.C.	41
J.F.	32	O.C.	22
D.G.	24	D.E.	33
P.H.	44	E.F.	32
N.K.	41	P.F.	24
T.L.	43	S.H.	24
B.M.	33	E.J.	43
E.M.	27	B.L.	45
S.M.	41	D.M.	25
L.P.	26	N.M.	38
D.R.	42	T.M.	33
P.R.	42	M.P.	33
R.Su.	46	B.R.	21
B.V.	31	E.R.	32
C.W.	45	G.S.	30
K.W.	43	V.S.	35
S.W.	47	R.Sc.	23
M.Y.	38	R.M.T.	42
Number of Subjects	22		23
Mean	36.73		32.91
Standard Deviation	7.41		7.32

TABLE 14

ITEM ANALYSIS, ATONAL SIGHT SINGING TEST A
EXPERIMENTAL GROUP (N = 22)

Item Number	Index of Difficulty	Pt. Biserial Correlation
1	9	.04
2	50	.48
3	32	.59
4	55	.70
5	0	.00
6	27	.04
7	27	.33
8	41	.70
9	0	.00
10	14	.44
11	14	.16
12	18	.52
13	27	.40
14	41	.51
15	23	.31
16	23	.67
17	18	.55
18	0	.00
19	36	.56
20	14	.29
21	9	.36
22	36	.51
23	9	.09
24	23	.13
25	5	.11
26	0	.00
27	23	.09
28	18	.33

TABLE 14--Continued

Item Number	Item of Difficulty	Pt. Biserial Correlation
29	9	.41
30	14	.37
31	23	.11
32	14	.50
33	18	.30
34	18	.14
35	41	.51
36	32	.42
37	9	.29
38	18	.49
39	36	.48
40	41	.51
41	27	.54
42	14	.07
43	23	.56
44	36	.71
45	14	.46
46	41	.34
47	18	.38
48	23	.52

Reliability = .86.

TABLE 15

ITEM ANALYSIS, ATONAL SIGHT SINGING TEST A
CONTROL GROUP (N = 23)

Item Number	Index of Difficulty	Pt. Biserial Correlation
1	26	.16
2	65	.57
3	39	.62
4	35	.24
5	9	.36
6	43	.45
7	9	.36
8	43	.46
9	4	.28
10	4	.28
11	13	.11
12	30	.38
13	35	.23
14	43	.17
15	39	.44
16	35	.48
17	30	.41
18	9	.36
19	26	.43
20	22	.43
21	9	.36
22	30	.36
23	26	.46
24	57	.61
25	4	.11
26	9	.36
27	17	.17
28	26	.31

TABLE 15--Continued

Item Number	Index of Difficulty	Pt. Biserial Correlation
29	4	.14
30	13	.04
31	13	.43
32	26	.43
33	26	.07
34	30	.38
35	30	.47
36	26	.15
37	0	.00
38	17	.53
39	22	.30
40	30	-.02
41	22	.35
42	17	.30
43	17	.19
44	43	.23
45	0	.00
46	39	.38
47	35	-.02
48	48	.36

Reliability = .7988.

TABLE 16

ITEM ANALYSIS, ATONAL SIGHT SINGING TEST B
EXPERIMENTAL GROUP (N = 22)

Item Number	Index of Difficulty	Pt. Biserial Correlation
1	32	.58
2	45	.74
3	23	.61
4	45	.18
5	5	.20
6	32	.46
7	18	.24
8	32	.24
9	5	.38
10	23	.52
11	9	.36
12	18	.49
13	14	.19
14	9	.45
15	32	.57
16	18	.24
17	18	.47
18	0	.00
19	55	.43
20	14	.28
21	9	.01
22	0	.00
23	14	.24
24	41	.63
25	27	.65
26	14	.35
27	18	.52
28	9	.40

TABLE 16--Continued

Item Number	Index of Difficulty	Pt. Biserial Correlation
29	36	.64
30	9	.01
31	23	.34
32	23	.41
33	55	.30
34	9	.01
35	18	.11
36	27	.53
37	0	.00
38	32	.58
39	32	.65
40	36	.27
41	45	.42
42	14	.44
43	32	.26
44	18	.21
45	9	.32
46	32	.41
47	59	.48
48	41	.42

Reliability = .87.

TABLE 17

ITEM ANALYSIS, ATONAL SIGHT SINGING TEST B
CONTROL GROUP (N = 23)

Item Number	Index of Difficulty	Pt. Biserial Correlation
1	22	.35
2	43	.32
3	22	-.05
4	61	.02
5	13	.14
6	35	.60
7	22	.44
8	13	.41
9	9	.28
10	35	.44
11	4	.30
12	22	.33
13	26	.35
14	9	.41
15	26	.32
16	26	.26
17	13	.23
18	0	.00
19	78	.32
20	52	.32
21	13	.18
22	22	.42
23	57	.72
24	30	.47
25	30	.32
26	30	.36
27	22	.38
28	39	.53

TEST 17--Continued

Item Number	Index of Difficulty	Pt. Biserial Correlation
29	48	.56
30	30	-.01
31	52	.46
32	30	-.06
33	65	.48
34	26	.49
35	35	.32
36	26	.14
37	9	.38
38	35	.44
39	39	.29
40	52	.41
41	48	.33
42	17	-.01
43	48	.80
44	48	.34
45	9	.41
46	35	.67
47	48	.32
48	35	.41

Reliability = .84.

TABLE 18

DIFFERENCE BETWEEN MEAN SCORES OF MALE AND FEMALE SUBJECTS ON ATONAL SIGHT SINGING TESTS A AND B

Group &	Factor	Mean	S.D.	df	t	Test
Exp.	Male	36.50	7.48			
Exp.	Female	37.92	6.61	20	.42	A
Exp.	Male	36.25	8.06			
Exp.	Female	37.00	6.71	20	.21	B
Exp.	Male	36.50	7.48			
Con.	Female	35.71	6.40	20	.23	A
Exp.	Male	36.25	8.06			
Con.	Female	32.57	7.62	20	.99	B
Exp.	Male	36.44	5.47			
Con.	Female	35.71	6.40	21	.28	A
Con.	Male	33.44	6.38			
Con.	Female	32.57	7.62	21	.28	B

TABLE 18--Continued

Group & Factor	Mean	S.D.	df	t	Test
Con. Male	36.44	5.47			
Exp. Female	37.92	6.61	21	.55	A
Con. Male	33.44	6.38			
Exp. Female	37.00	6.71	21	1.22	B
Exp. Male	36.50	7.48			
Con. Male	36.44	5.47	15	.02	A
Exp. Male	36.25	8.06			
Con. Male	33.44	6.38	15	.74	B
Exp. Female	37.92	6.61			
Con. Female	35.71	6.40	26	.87	A
Exp. Female	37.00	6.71			
Con. Female	32.57	7.62	26	1.57	B

TABLE 19

DIFFERENCE BETWEEN MEAN SCORES OF SUBJECTS WITH AND WITHOUT KEYBOARD EXPERIENCE ON ATONAL SIGHT SINGING TESTS A AND B

Group & Factor	Mean	S.D.	df	t	Test
Exp. Keybd.	39.08	6.60			
Exp. N-Keybd.	35.00	6.70	20	1.34	A
Exp. Keybd.	38.15	6.45			
Exp. N-Keybd.	34.55	8.12	20	1.05	B
Exp. Keybd.	39.08	6.60			
Con. N-Keybd.	38.67	5.47	23	.16	A
Exp. Keybd.	38.15	6.45			
Con. N-Keybd.	35.33	6.60	23	1.04	B
Con. Keybd.	33.09	4.82			
Exp. N-Keybd.	35.00	6.70	18	.68	A
Con. Keybd.	30.27	6.83			
Exp. N-Keybd.	34.55	8.12	18	1.19	B
Con. Keybd.	33.09	4.82			
Con. N-Keybd.	38.67	5.47	21	2.49*	A

*Significant at .05 level of confidence.

TABLE 19--Continued

Group & Factor	Mean	S.D.	df	t	Test
Con. Keybd.	30.27	6.83			
Con. N-Keybd.	35.33	6.60	21	1.74	B
Exp. Keybd.	39.08	6.60			
Con. Keybd.	33.09	4.82	22	2.38*	A
Exp. Keybd.	38.15	6.45			
Con. Keybd.	30.27	6.83	22	2.80**	B
Exp. N-Keybd.	35.00	6.70			
Con. N-Keybd.	38.67	5.47	19	1.27	A
Exp. N-Keybd.	34.55	8.12			
Con. N-Keybd.	35.33	6.60	19	.23	B

*Significant at .05 level of confidence.

**Significant at .02 level of confidence.

TABLE 20

HIERARCHY OF INTERVALS AS DERIVED FROM THE ATONAL SIGHT SINGING TESTS

Order		Test A	Percent[a]	Test B	Percent[a]	Test A & B	Percent[a]
Least →	1	Mi. 2 D	90.25	Mi. 2 U	89.00	Mi. 2 D	88.500
	2	Ma. 2 U	84.50	Mi. 2 D	86.75	Mi. 2 U	85.125
D	3	P. 4 &	84.00	Ma. 2 U	85.25	Ma. 2 U	84.875
I	4	Ma. 2 D	83.75	Ma. 2 D	79.25	Ma. 2 D	81.500
F	5	Mi. 2 U	81.25	P. 4 U	75.00	P. 4 U	79.500
F	6	Mi. 3 U	79.75	Mi. 3 U	73.25	Mi. 3 U	76.500
I	7	P. 5 D	77.25	Ma. 3 U	70.75	Ma. 3 U	72.625
C	8	Ma. 3 U	74.50	P. 4 D	66.50	P. 5 D	70.875
U	9	P. 5 U	67.25	P. 5 D	64.50	P. 4 D	66.625
L	10	P. 4 D	66.75	P. 5 U	63.75	P. 5 U	65.500
T	11	Ma. 3 D	64.50	Mi. 3 D	63.00	Mi. 3 D	63.375
Most →	12	Mi. 3 D	63.75	Ma. 3 D	52.25	Ma. 3 D	58.375

[a]Figures indicate percentage of correctly sung intervals of both groups.

TABLE 21

OCTAVE DISPLACEMENT OF INTERVAL SERIES TONES ON ATONAL SIGHT SINGING TEST A[a]

Experimental Group			Control Group		
Female Subjects	8va Displ.	Total	Female Subjects	8va Displ.	Total
K.B.	14	33	A.B.	15	32
V.B.	13	29	J.B.	16	32
L.D.	20	45	J.C.	21	44
J.F.	11	34	E.F.	12	30
P.H.	18	43	P.F.	15	28
N.K.	21	43	S.H.	13	33
B.M.	14	31	E.J.	22	45
E.M.	13	30	B.L.	22	47
S.M.	18	40	M.P.	19	38
L.P.	13	28	B.R.	12	28
P.R.	22	43	E.R.	18	37
K.W.	19	44	V.S.	13	33
S.W.	23	48	R.Sc.	14	30
M.Y.	20	40	R.M.T.	20	43
Totals[b]	239	531		232	500

[a]Correct interval averages for these scores are shown in Table 13.

[b]The above scores indicate correctly sung intervals.

TABLE 21--Continued

Experimental Group			Control Group		
Male Subjects	8va Displ.	Total	Male Subjects	8va Displ.	Total
			B.A.	20	40
M.B.	14	30	D.B.	17	39
J.E.	12	29	I.C.	19	43
D.G.	15	27	O.C.	15	28
T.L.	20	43	D.E.	16	36
R.Su.	18	41	N.M.	19	43
B.V.	17	31	T.M.	17	39
C.W.	21	44	G.S.	13	30
Totals[b]	139	292		152	328
Female Totals	239	531		232	500
Male Totals	139	292		152	328
Comb. Totals	378	823		384	828

[a]Correct interval averages for these scores are shown in Table 13.

[b]The above scores indicate correctly sung intervals.

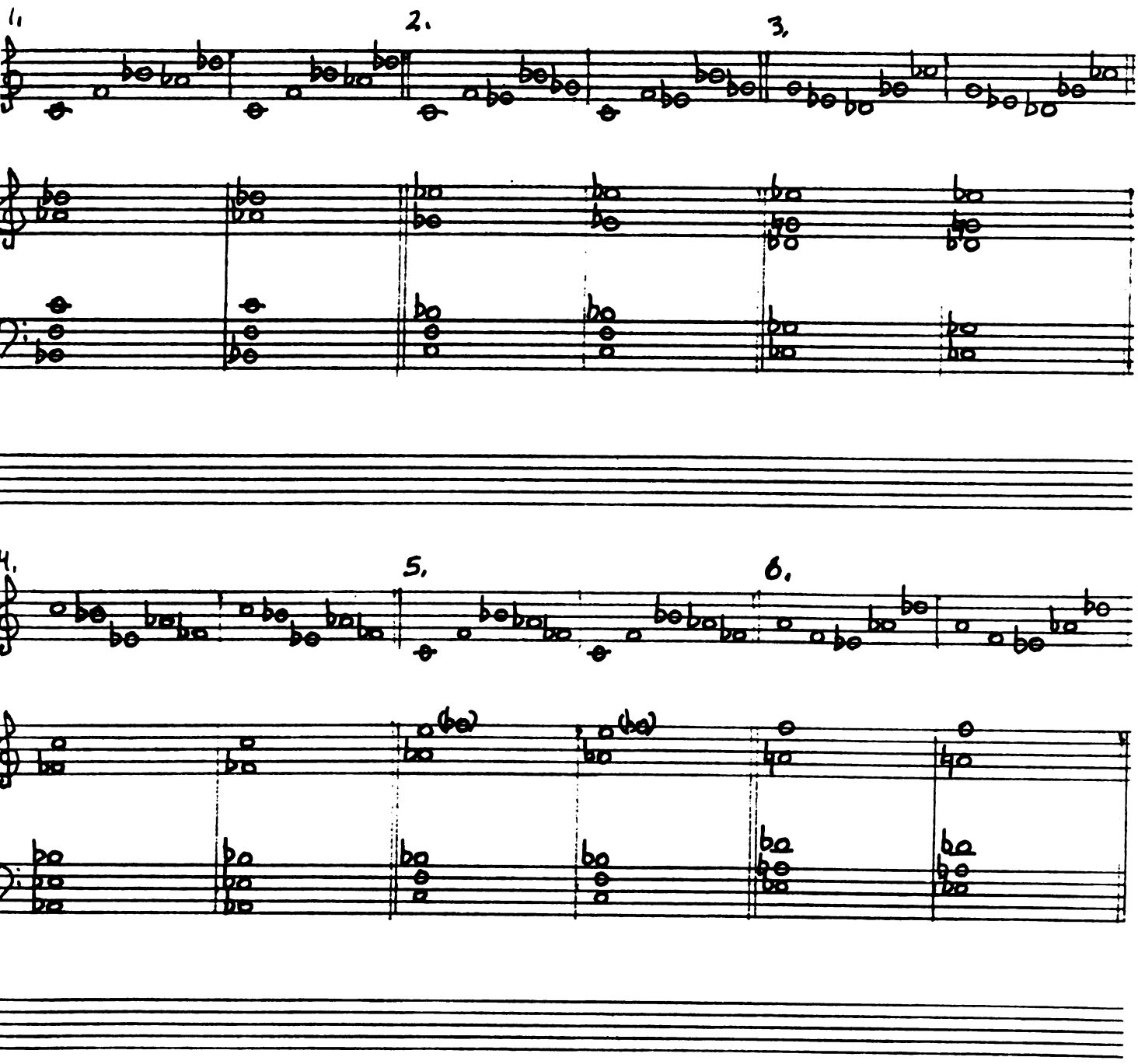
APPENDIX B

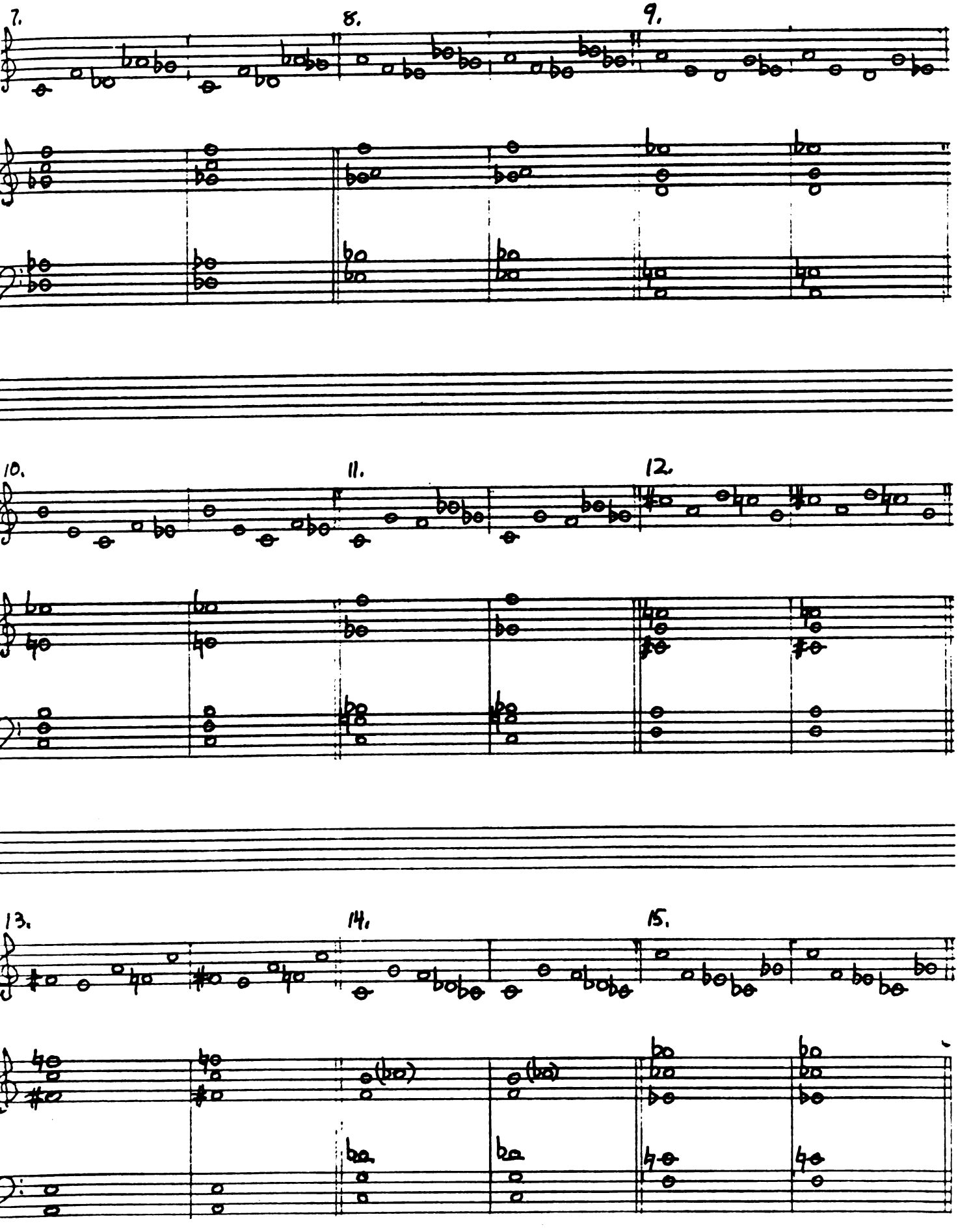
ATONAL SIGHT SINGING DRILLS FOR EXPERIMENTAL GROUP SUBJECTS

ATONAL SIGHT SINGING DRILLS

UNIT I

Name Date

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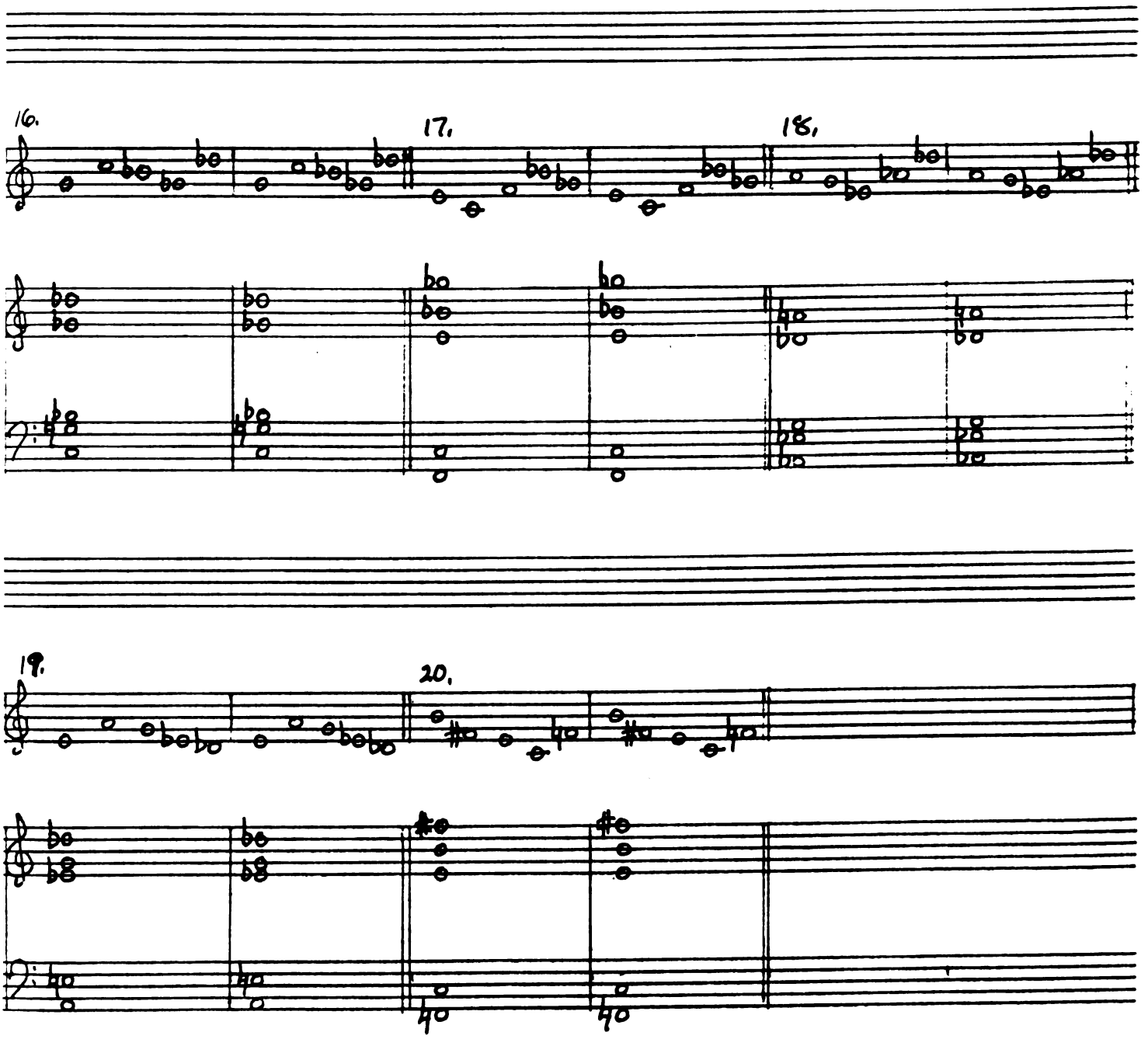
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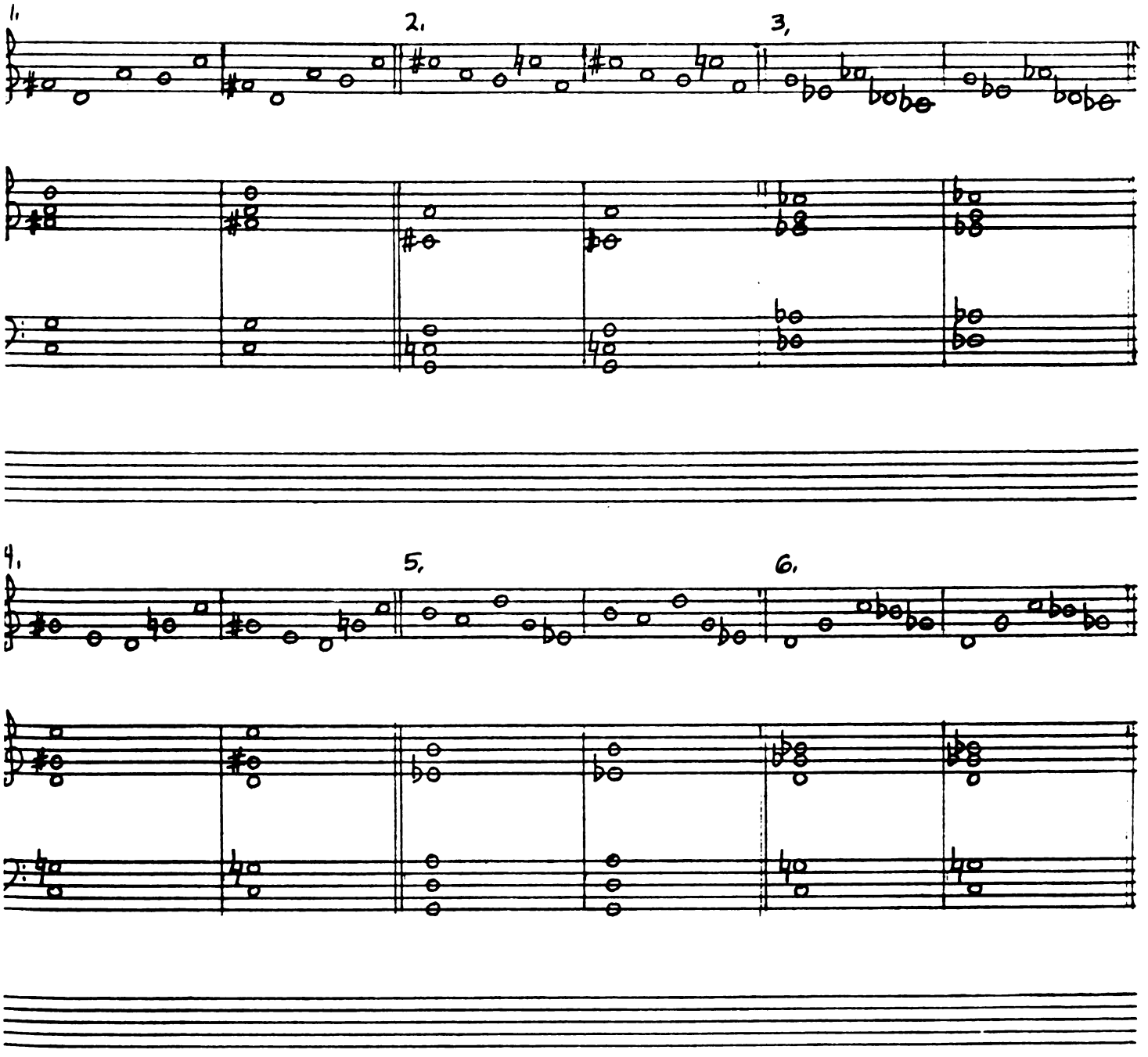
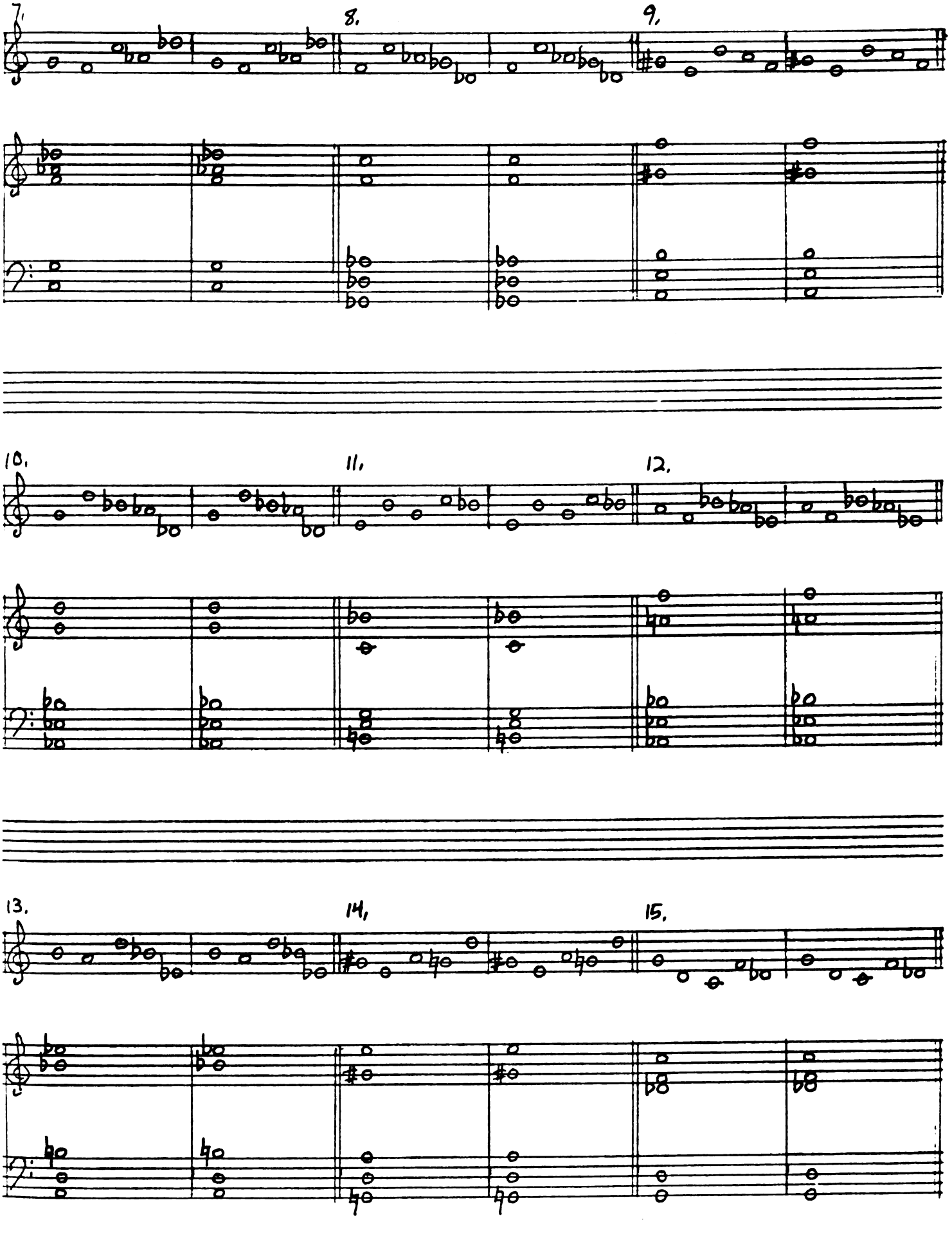
20.

ATONAL SIGHT SINGING DRILLS

UNIT II

Name **Date**

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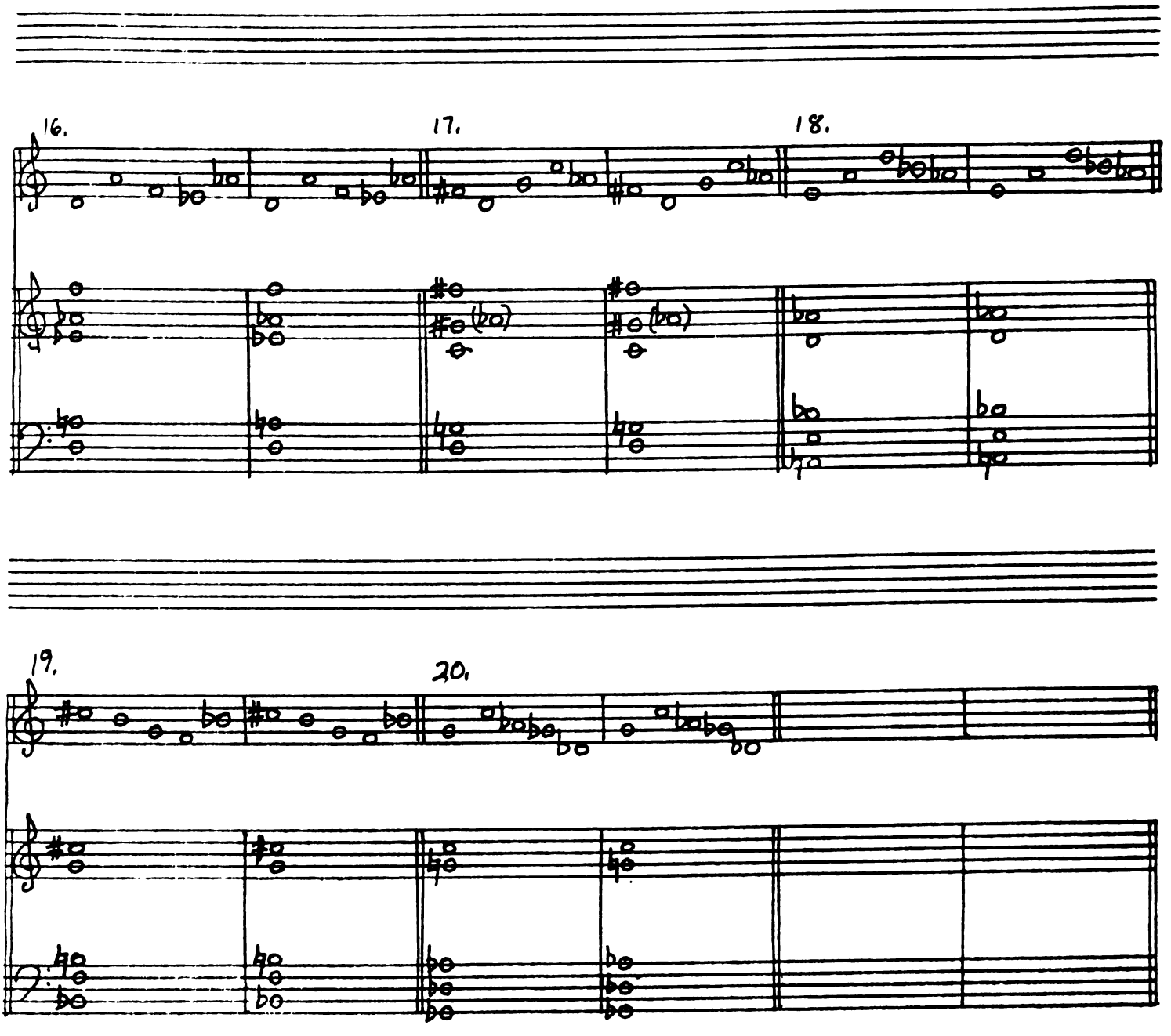
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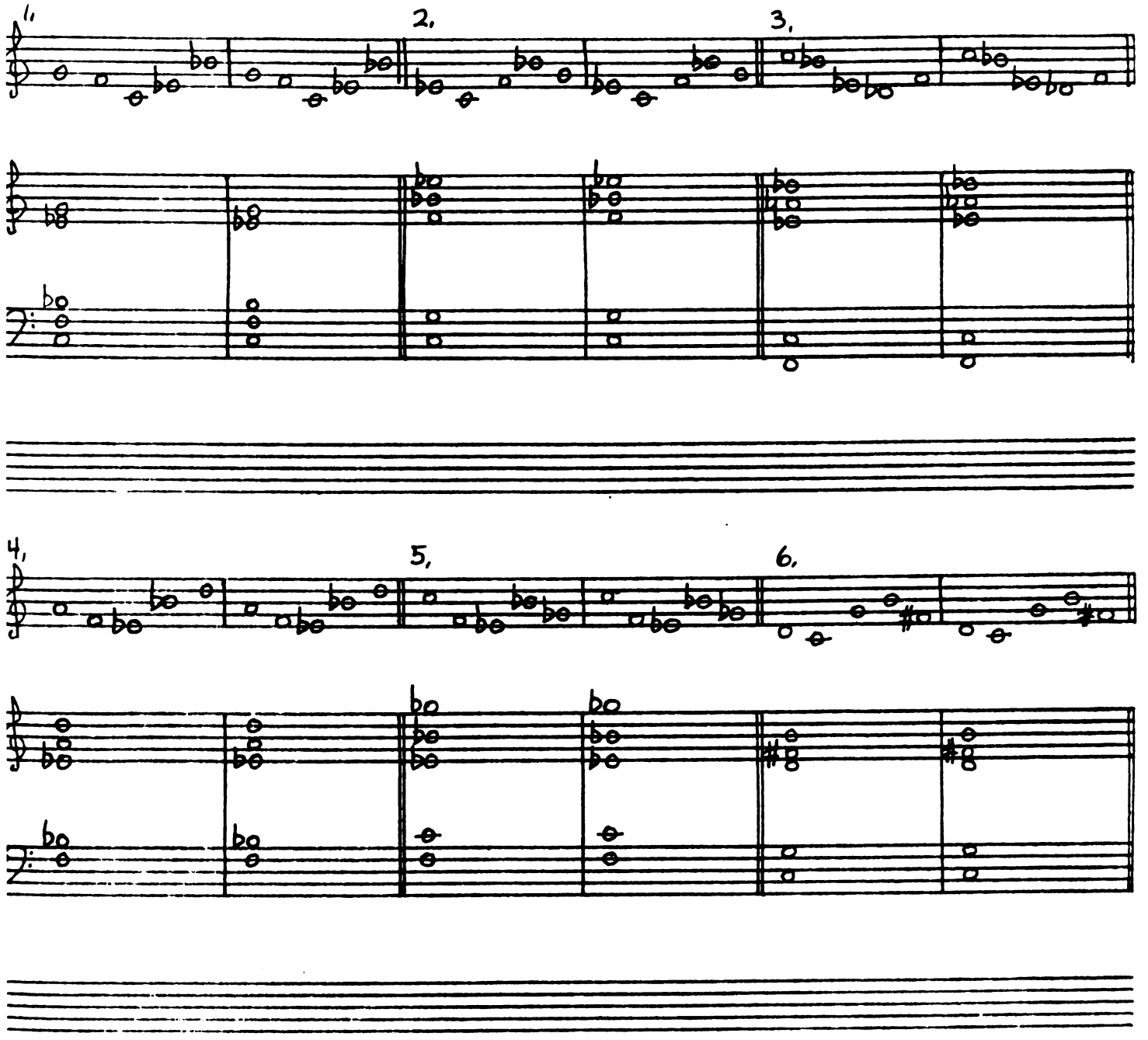
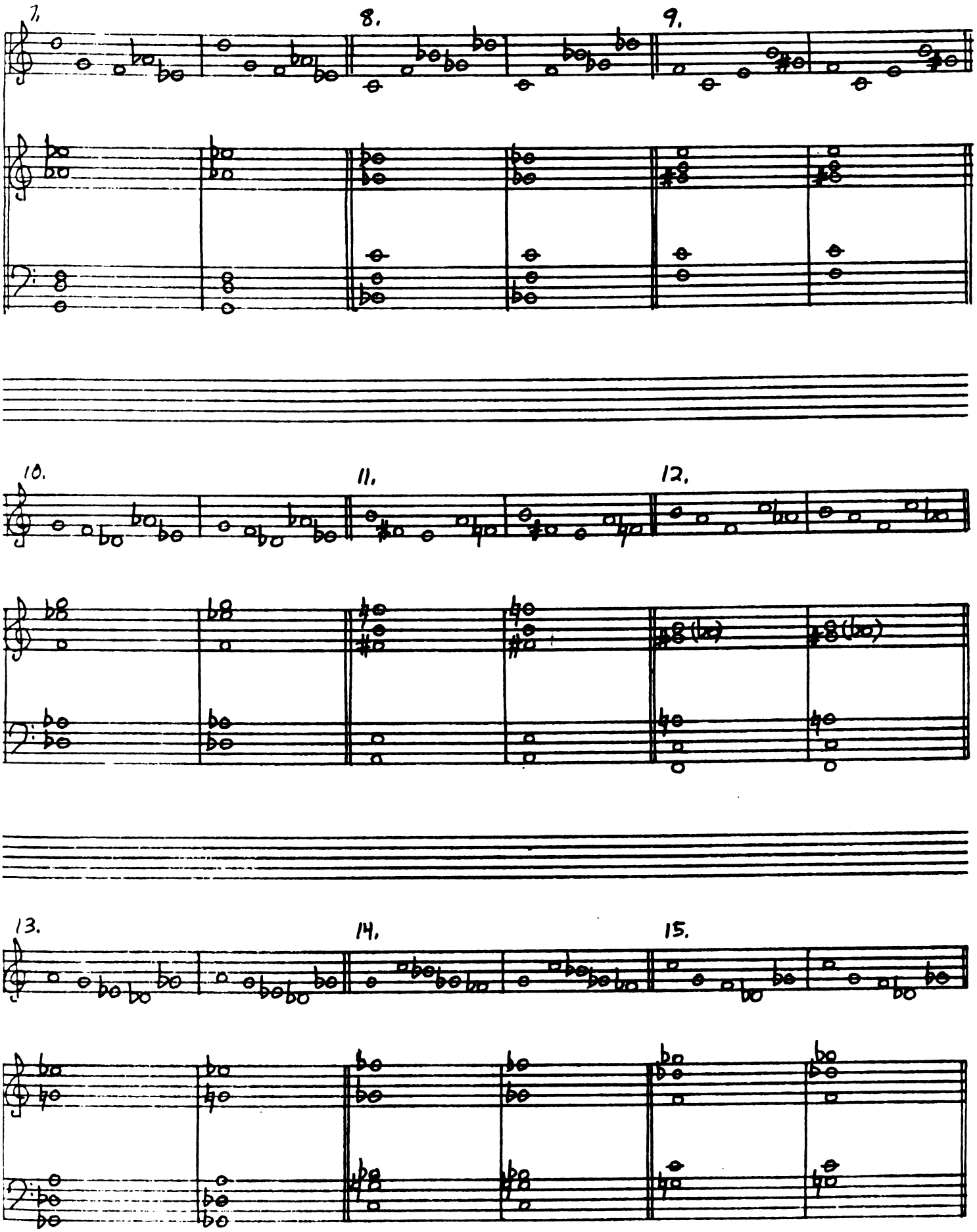
ATONAL SIGHT SINGING DRILLS

UNIT III

Name **Date**

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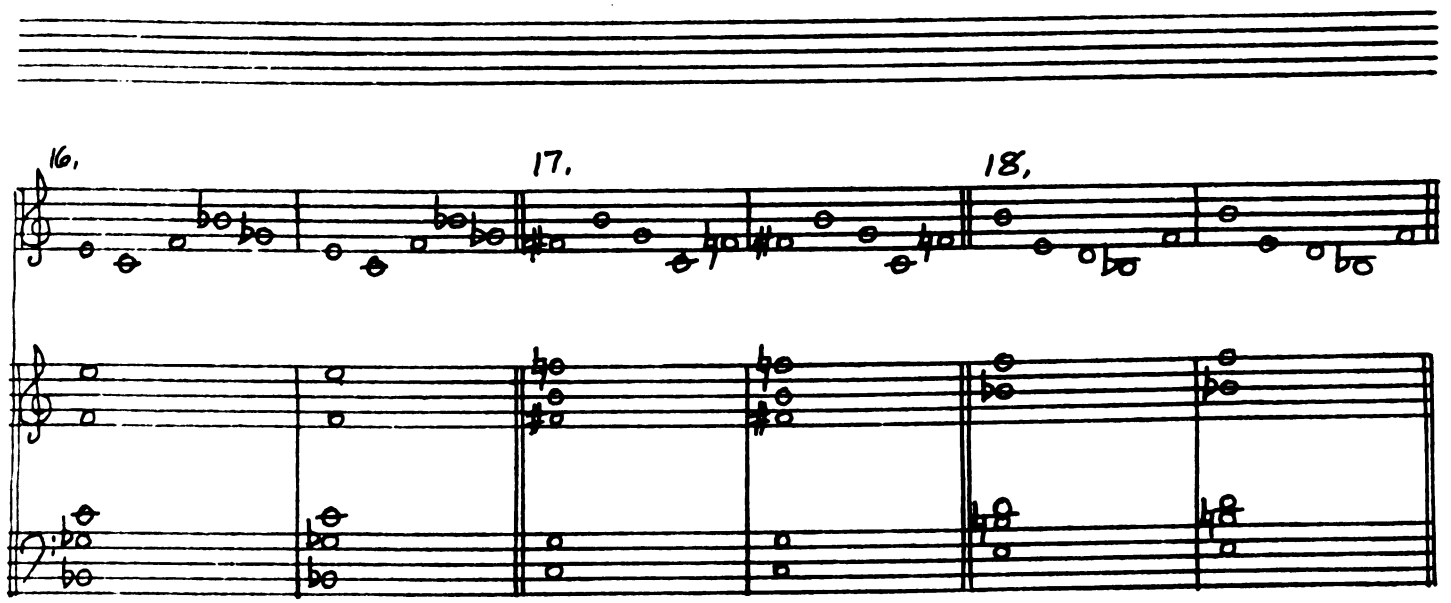
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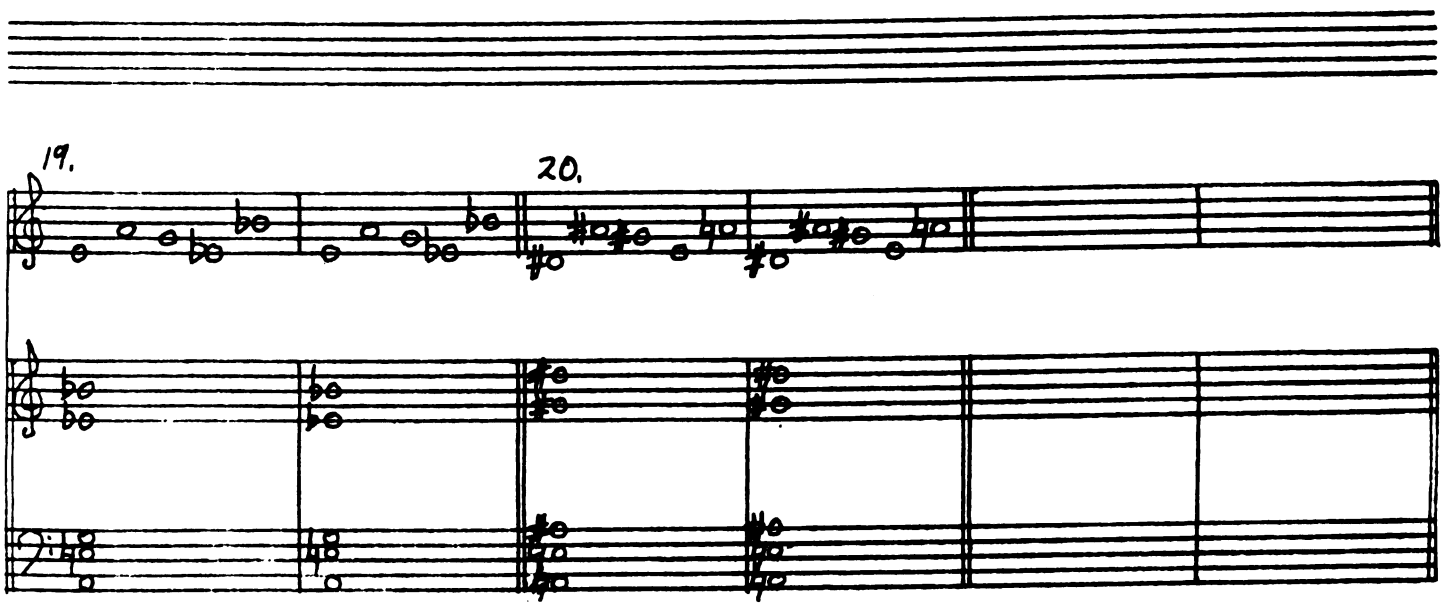
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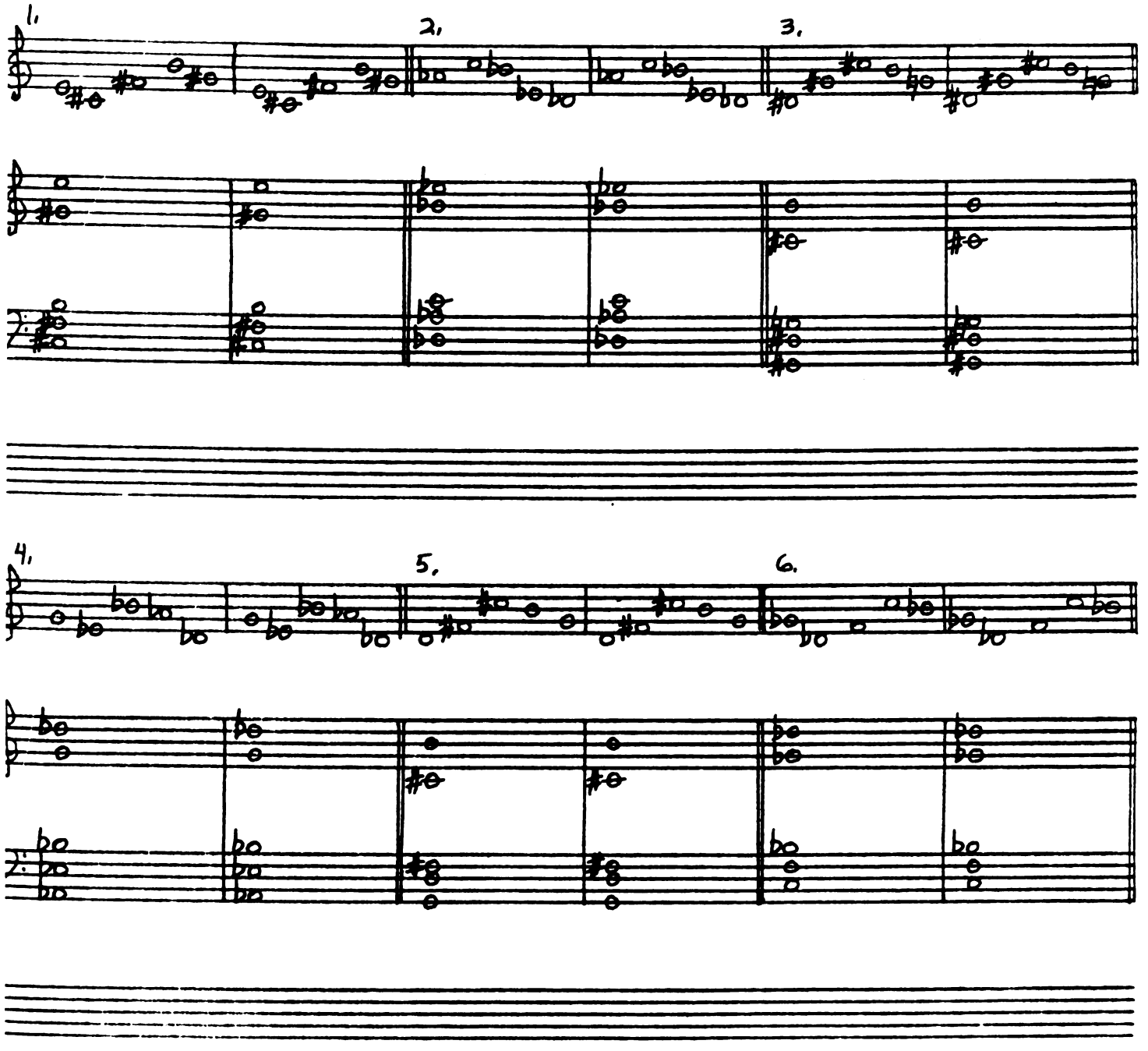
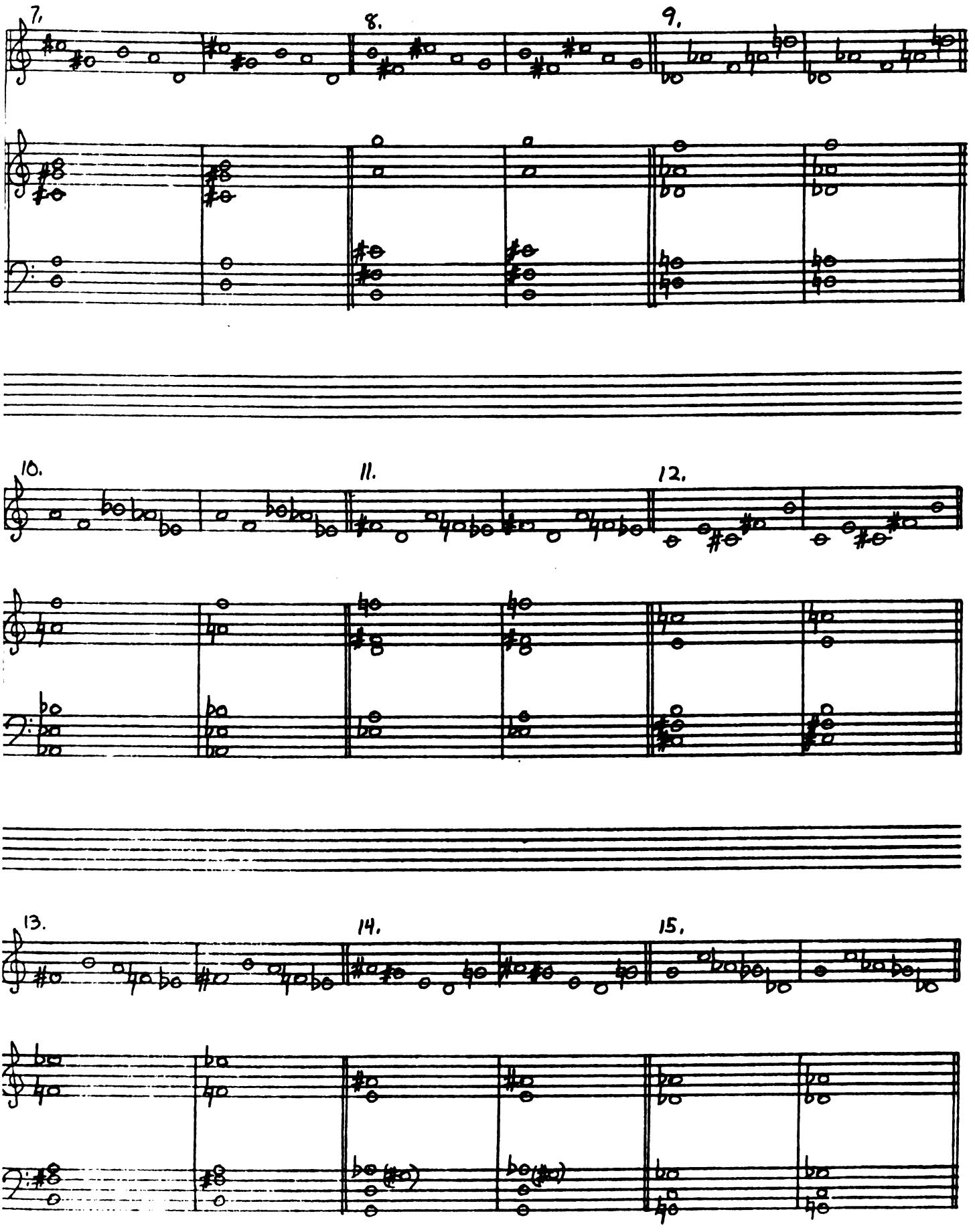
ATONAL SIGHT SINGING DRILLS

UNIT IV

Name Date

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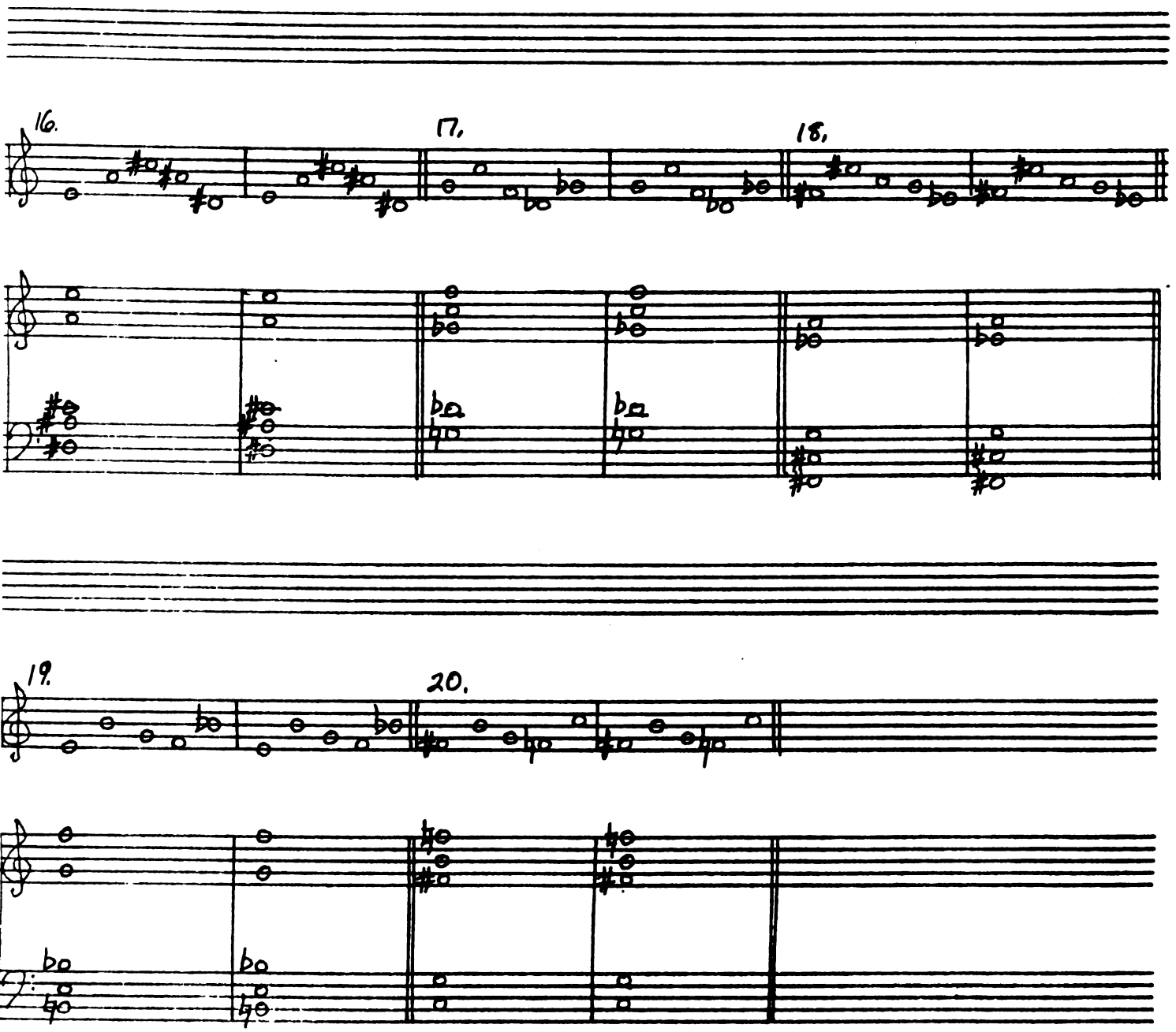
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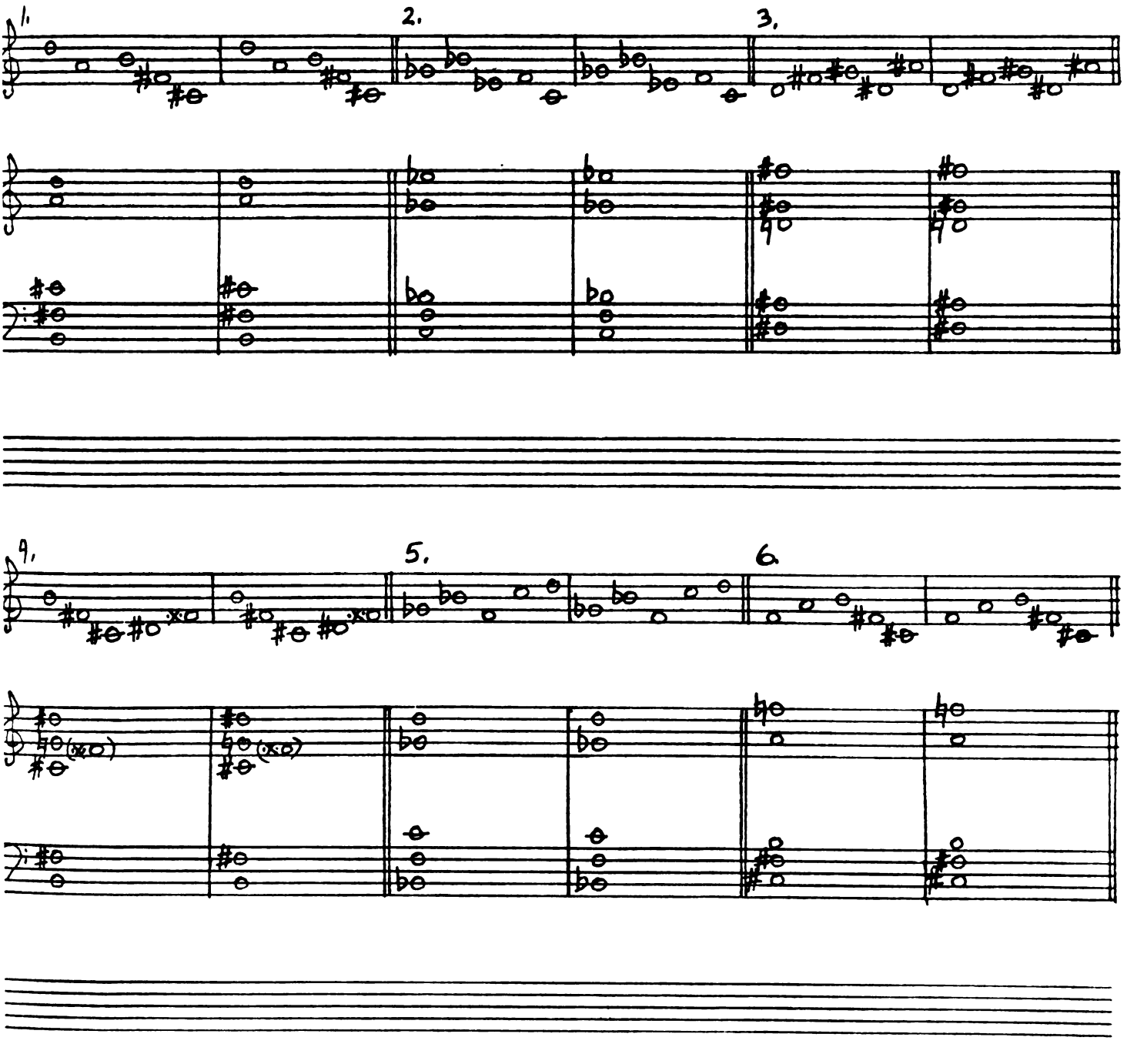
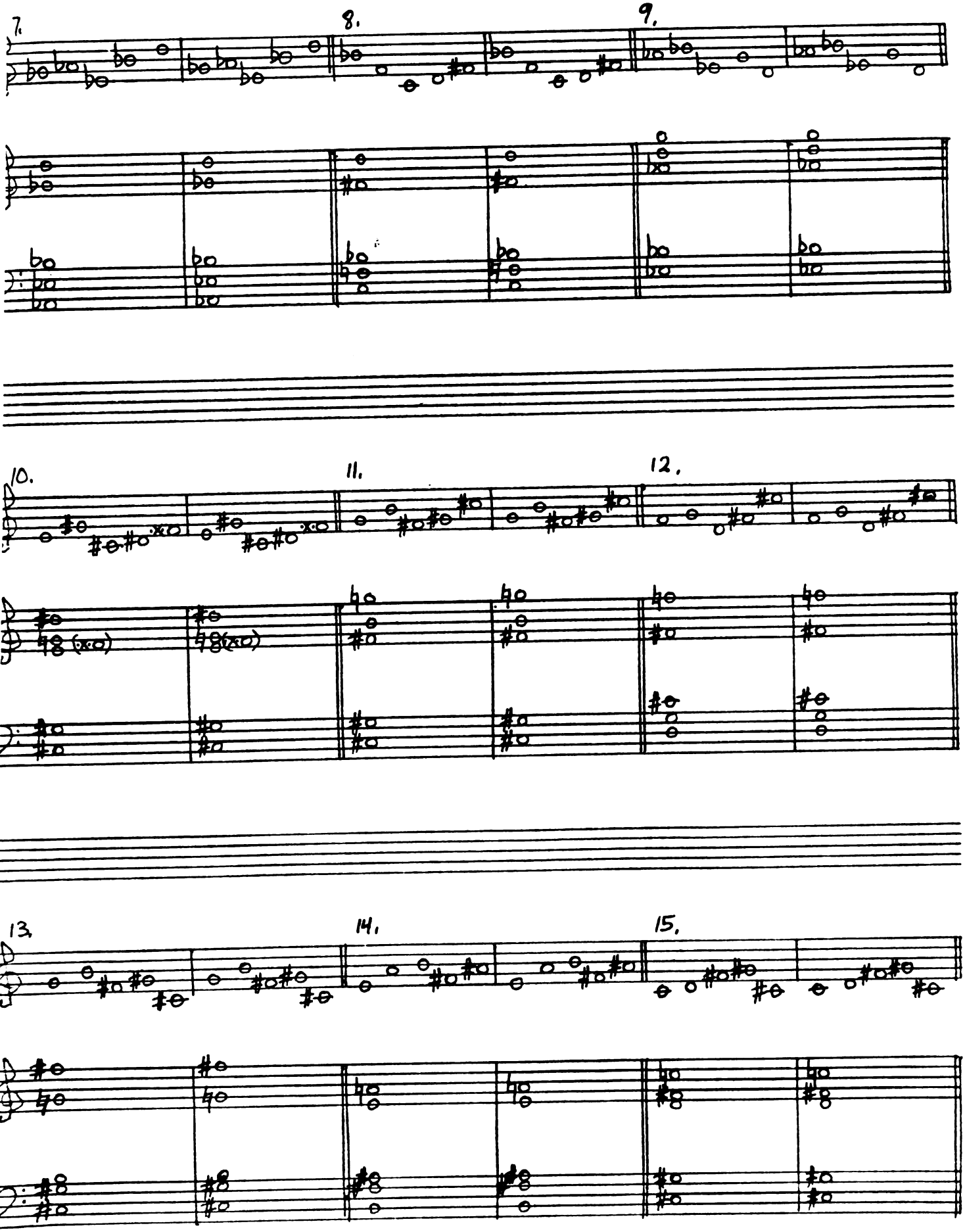
ATONAL SIGHT SINGING DRILLS

UNIT V

Name Date

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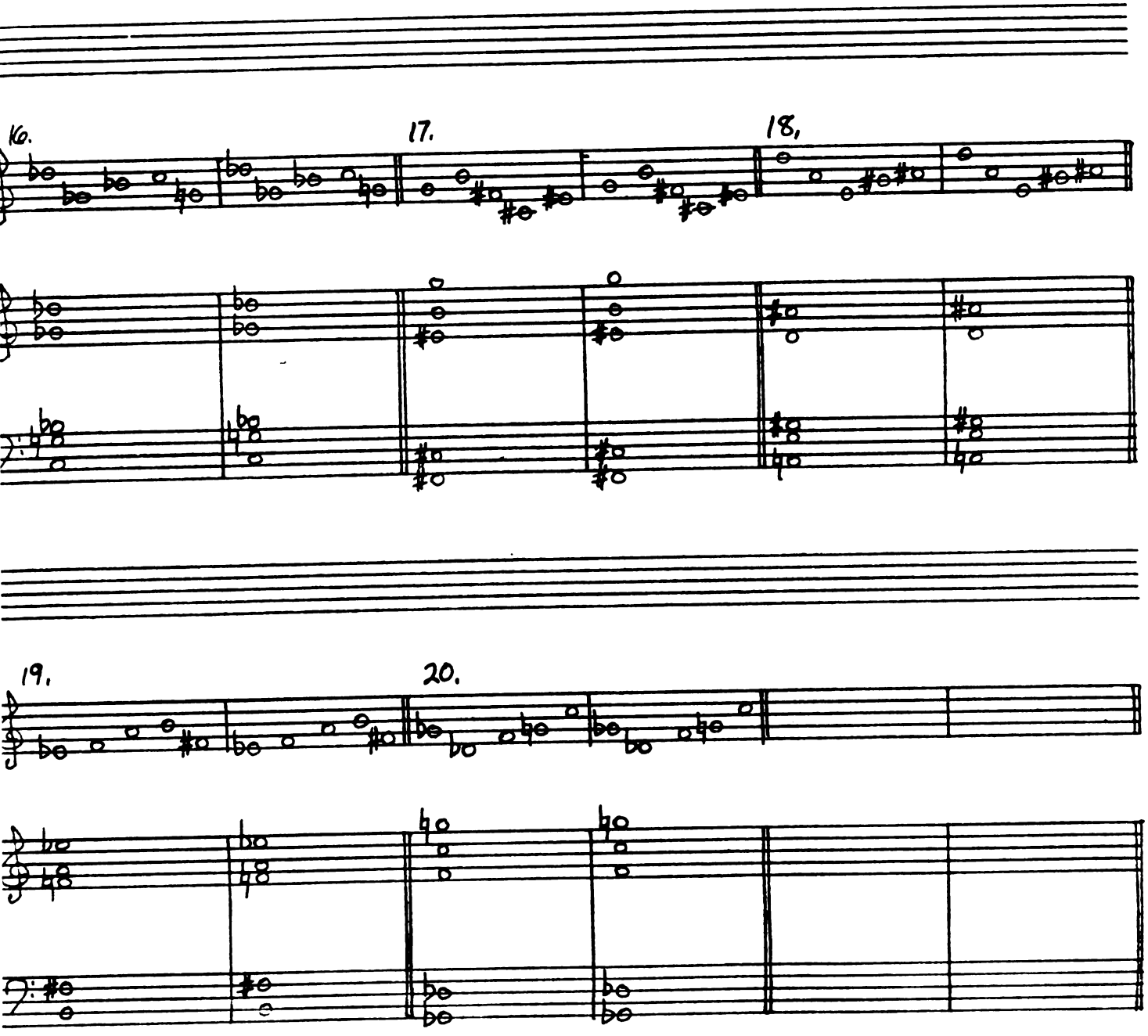
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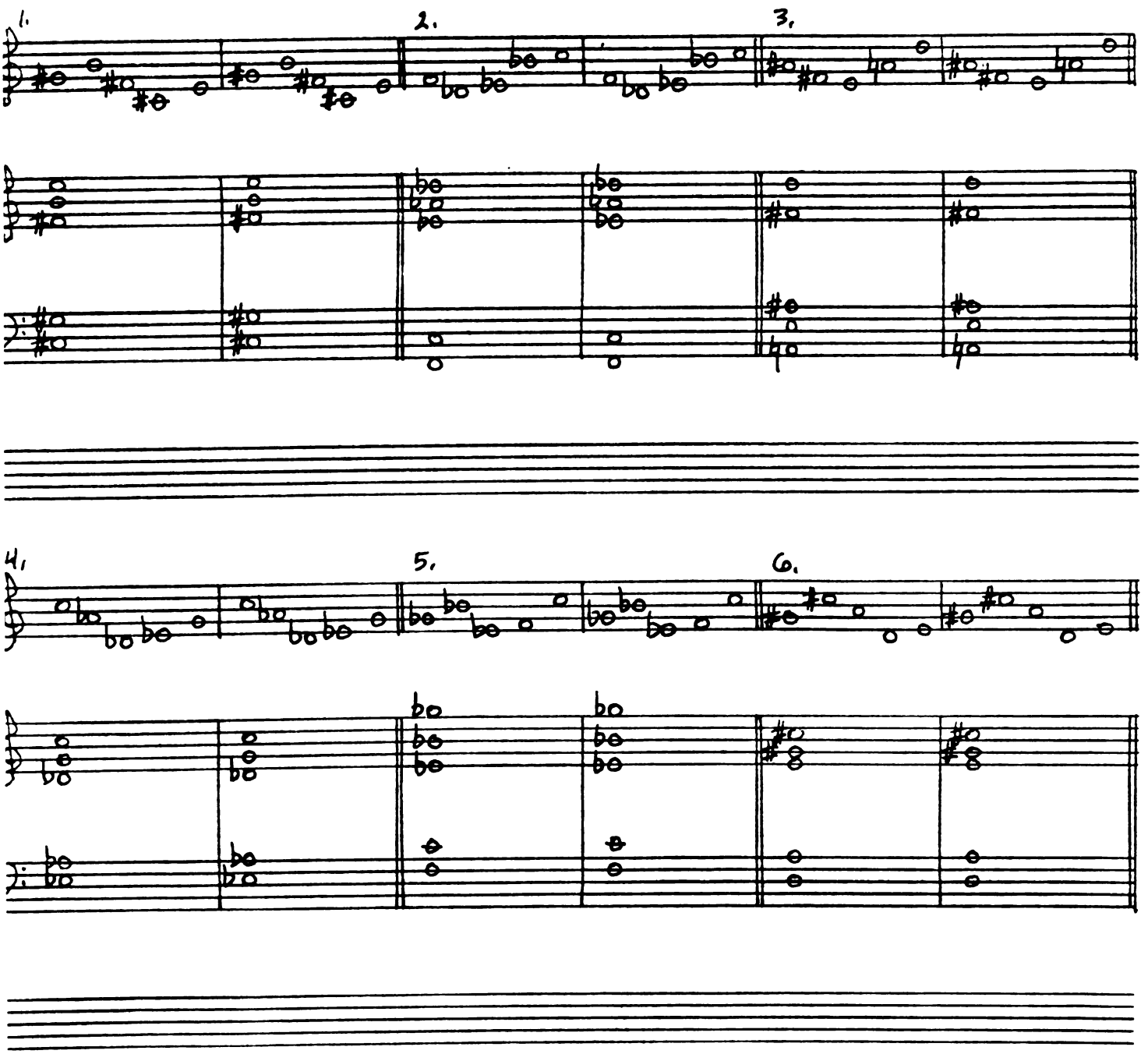
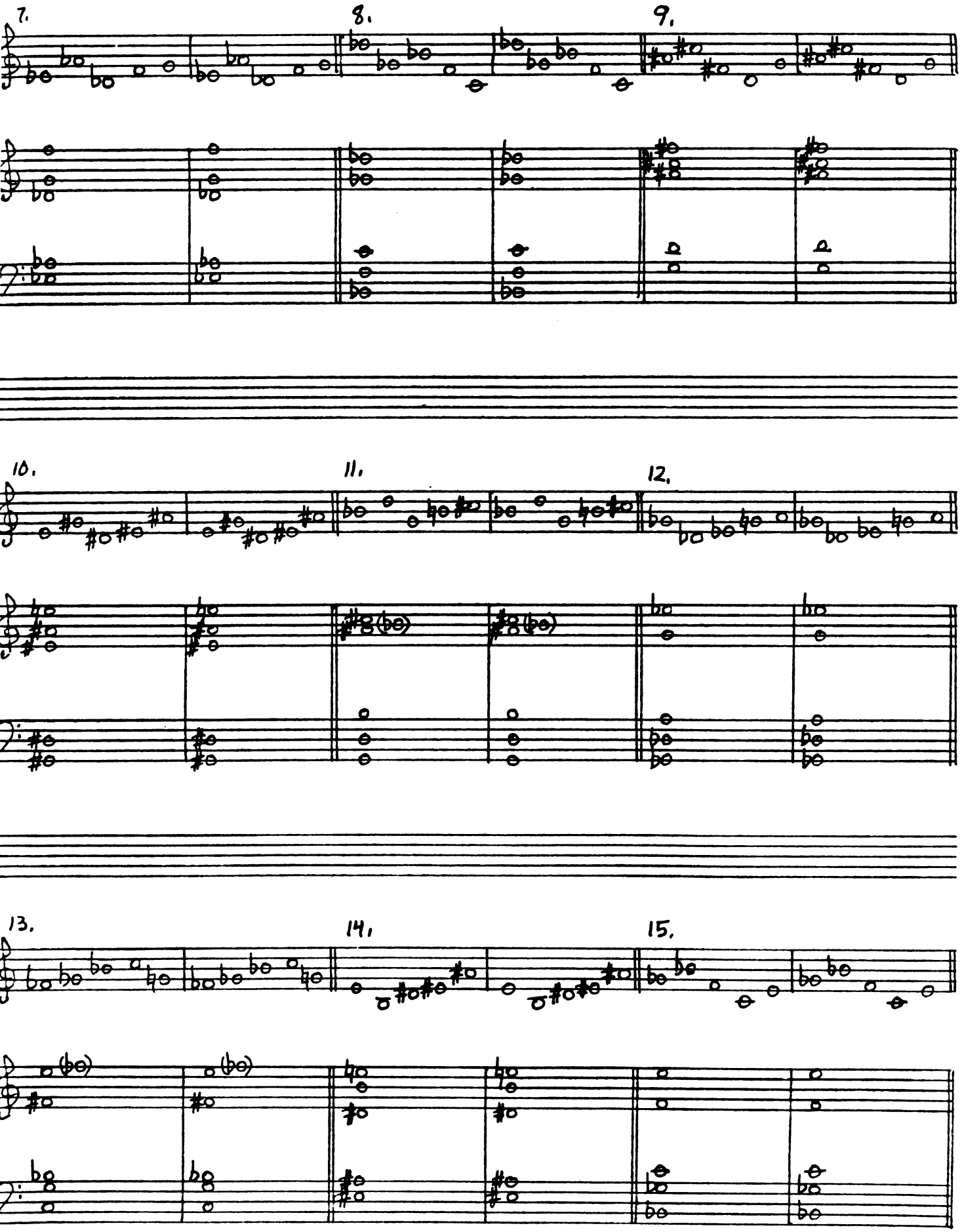
ATONAL SIGHT SINGING DRILLS

UNIT VI

Name Date

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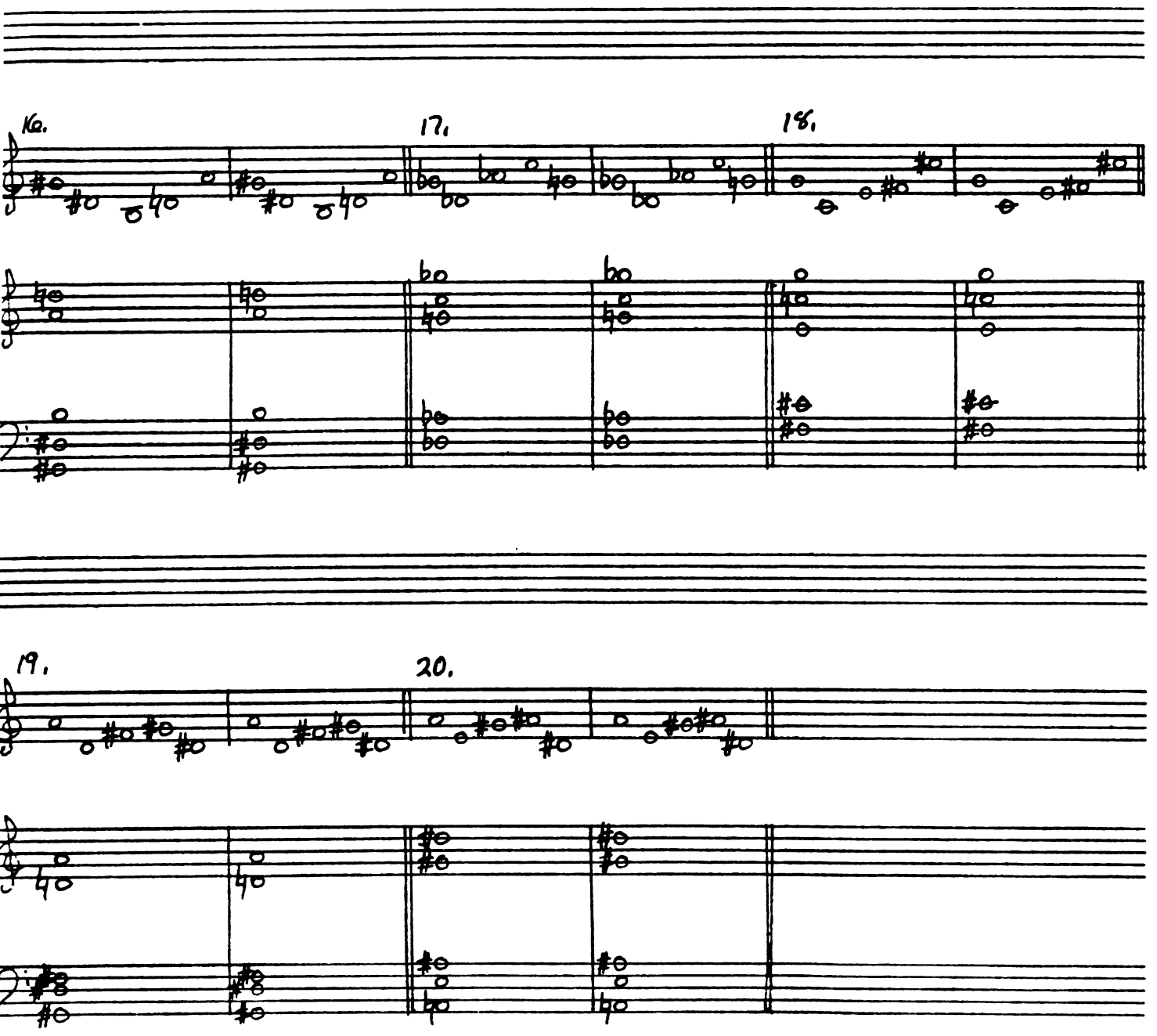
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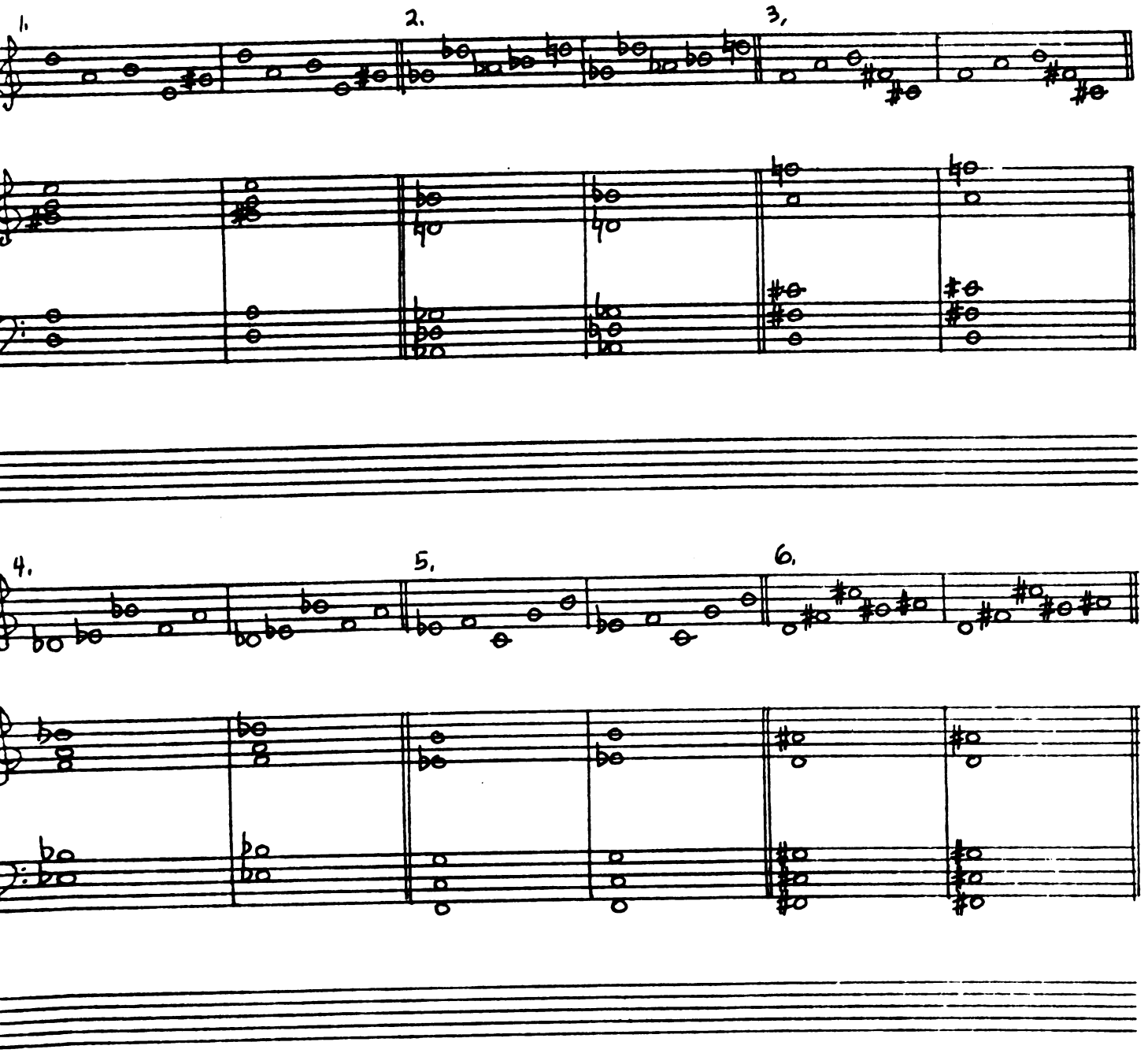
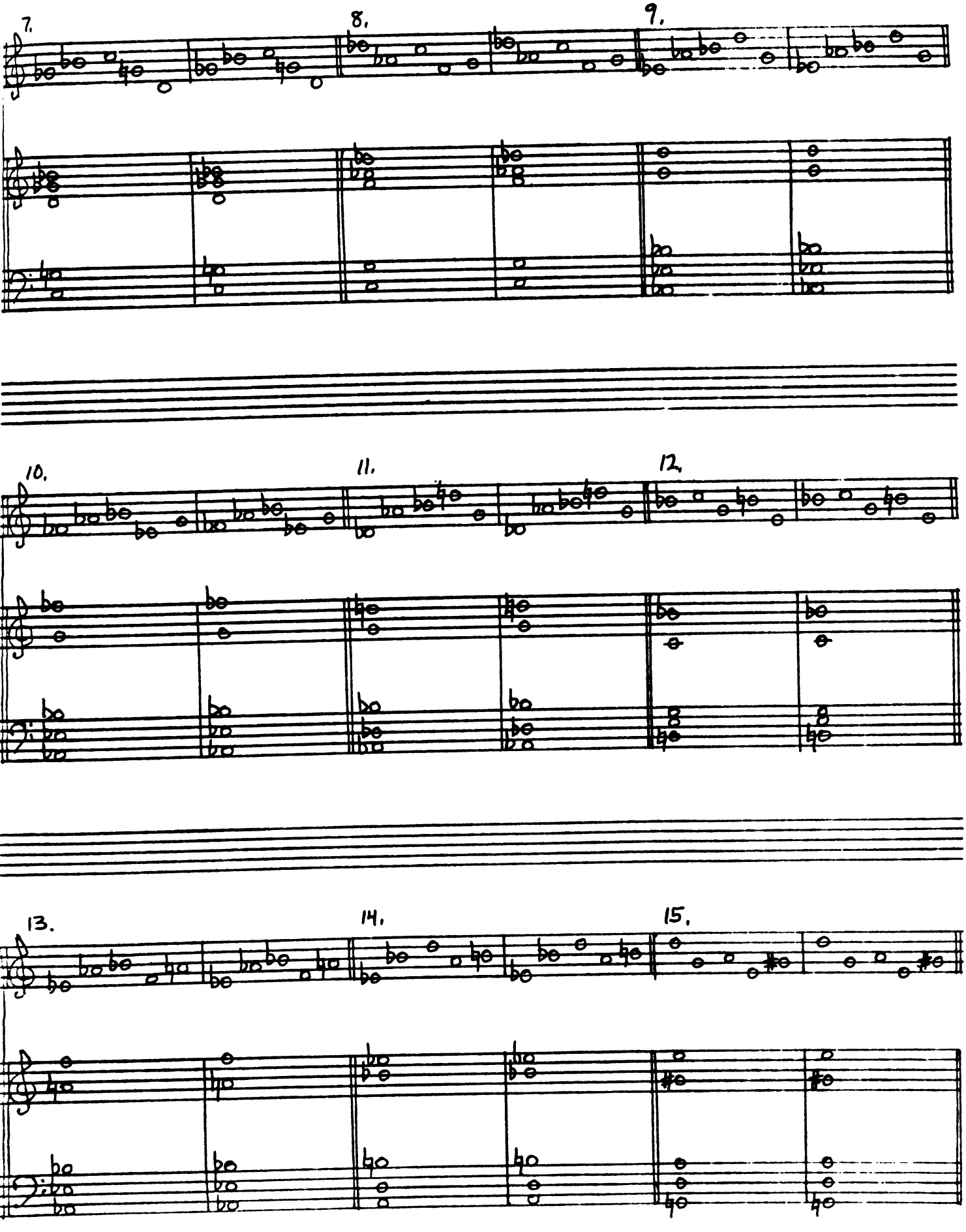
ATONAL SIGHT SINGING DRILLS

UNIT VII

Name Date

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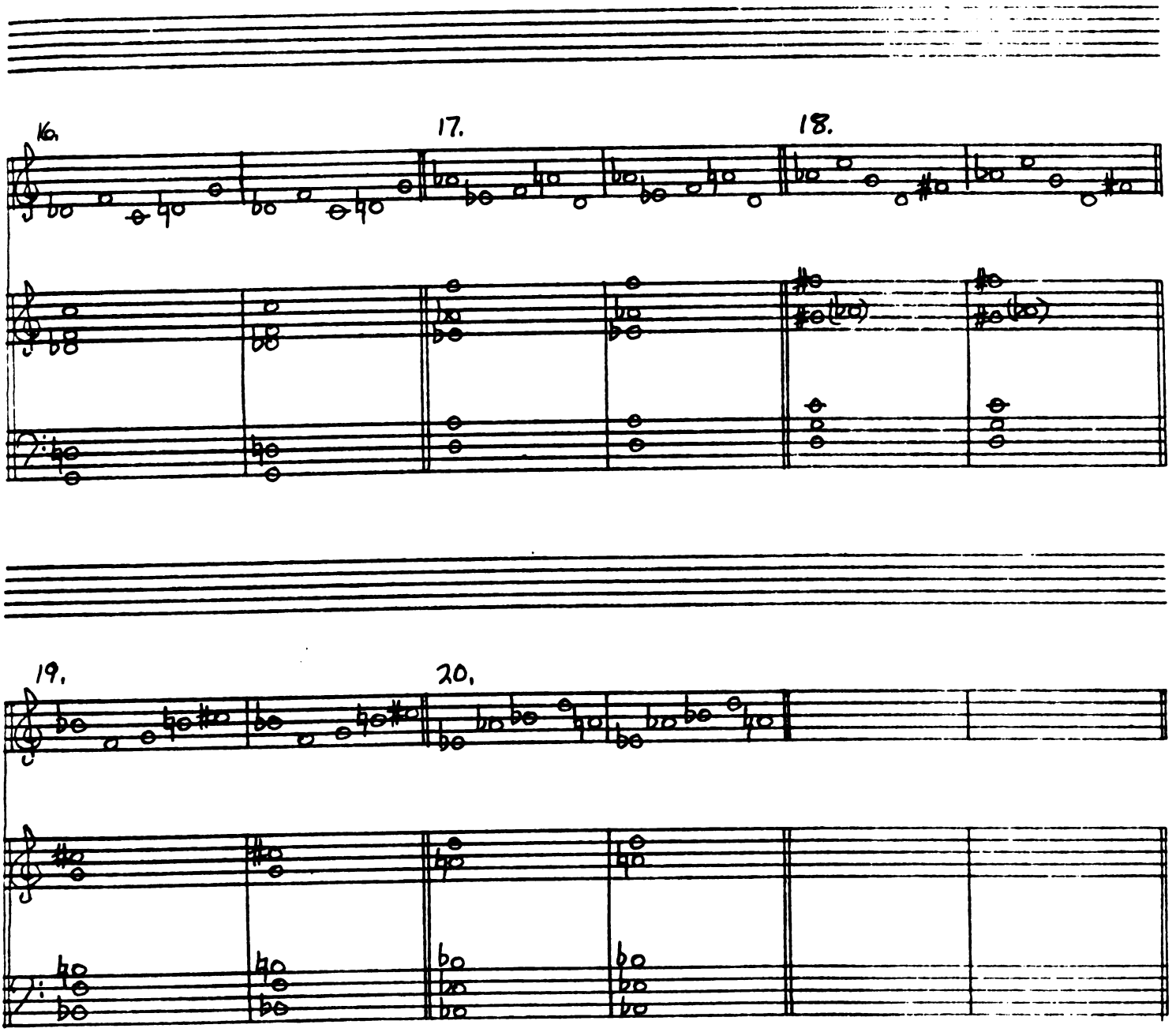
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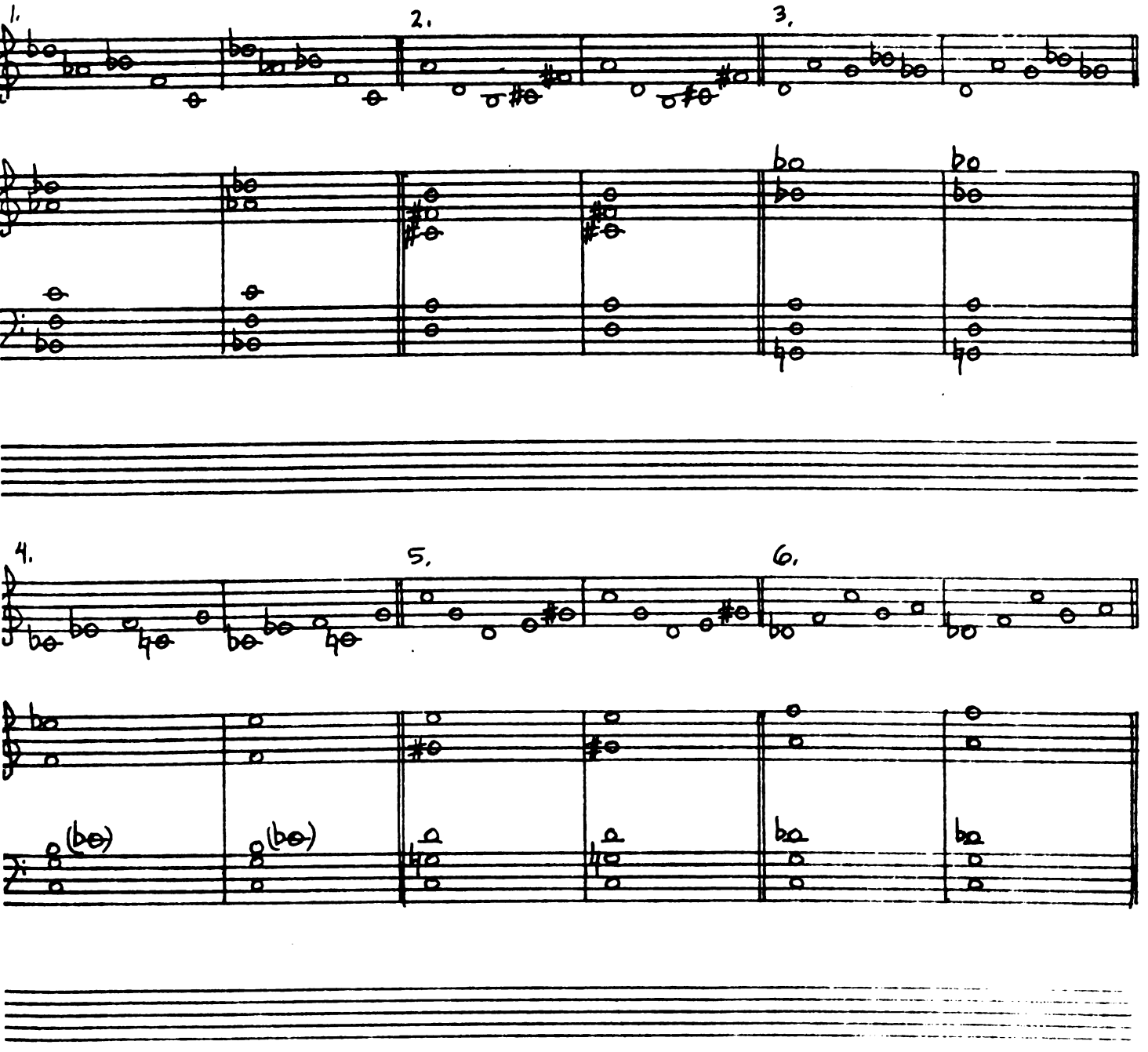
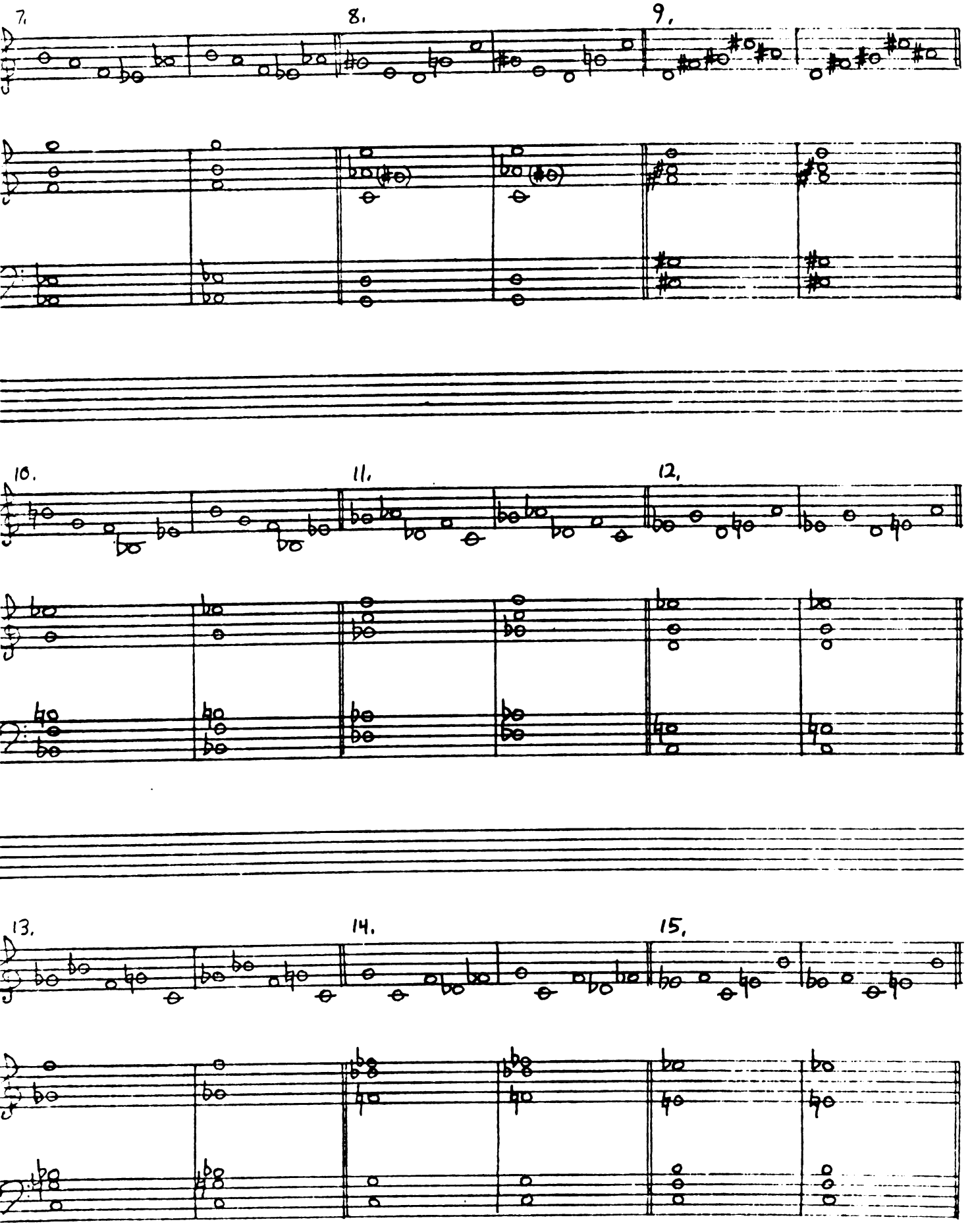
ATONAL SIGHT SINGING DRILLS

UNIT VIII

Name

Date

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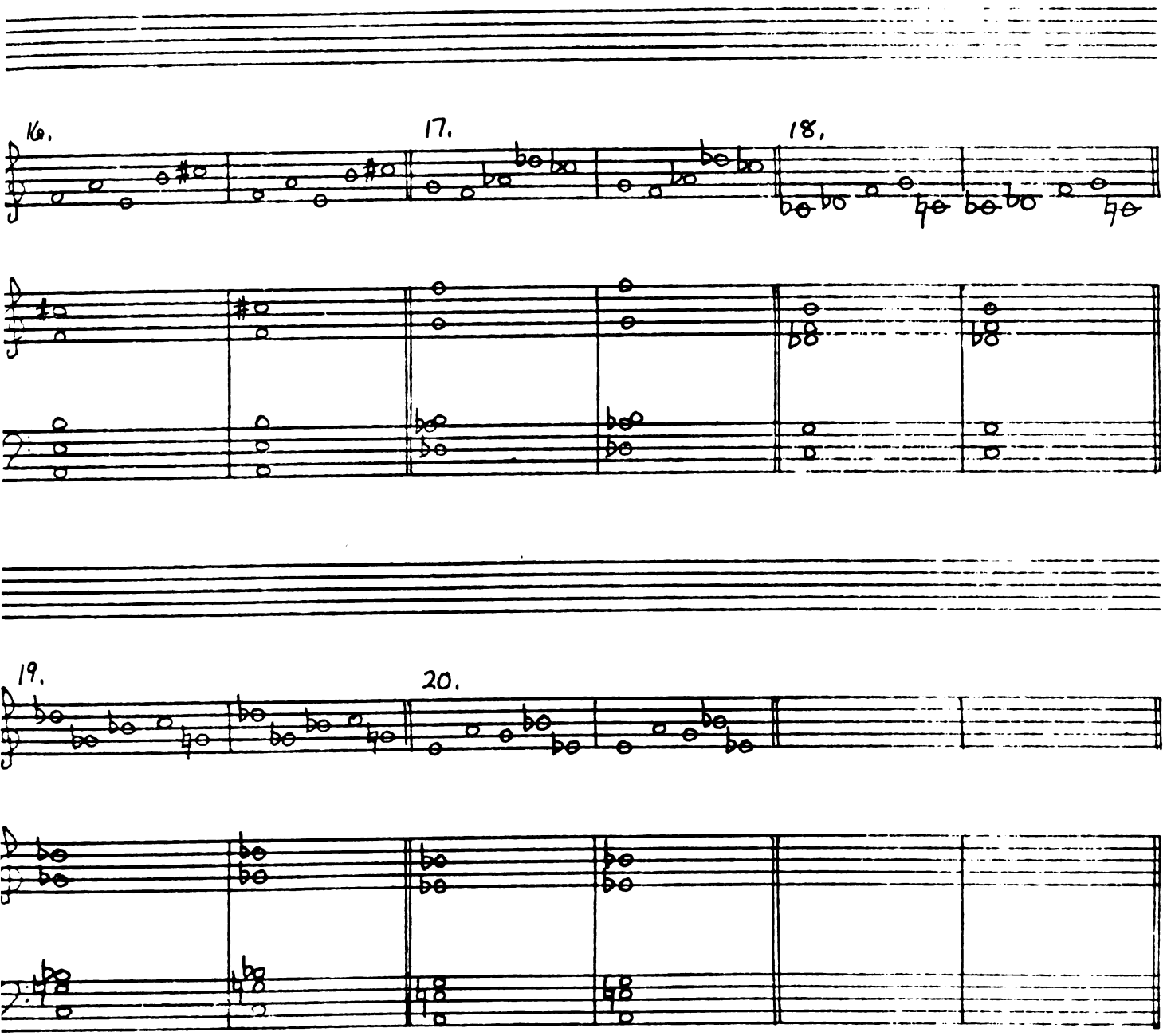
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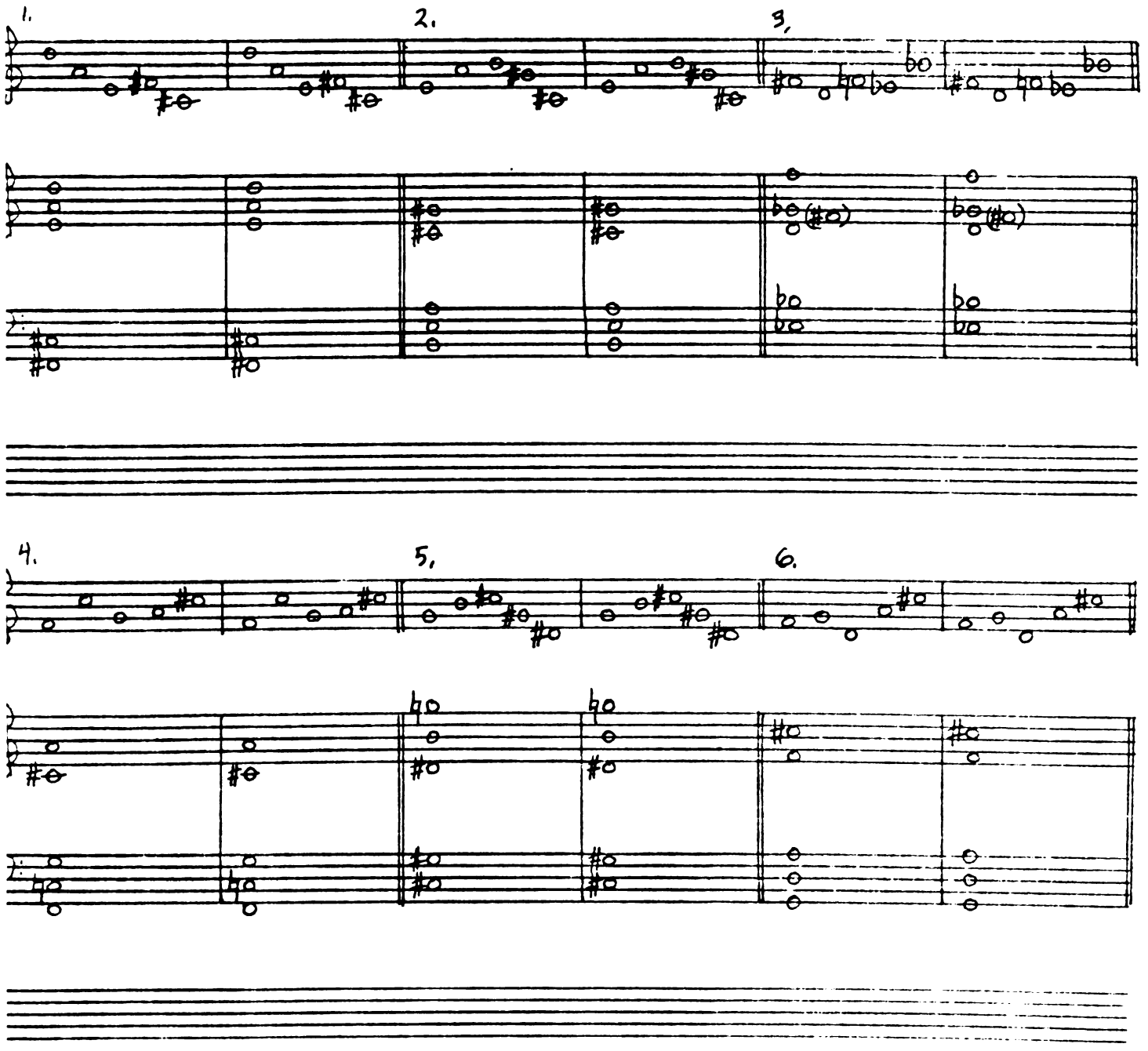
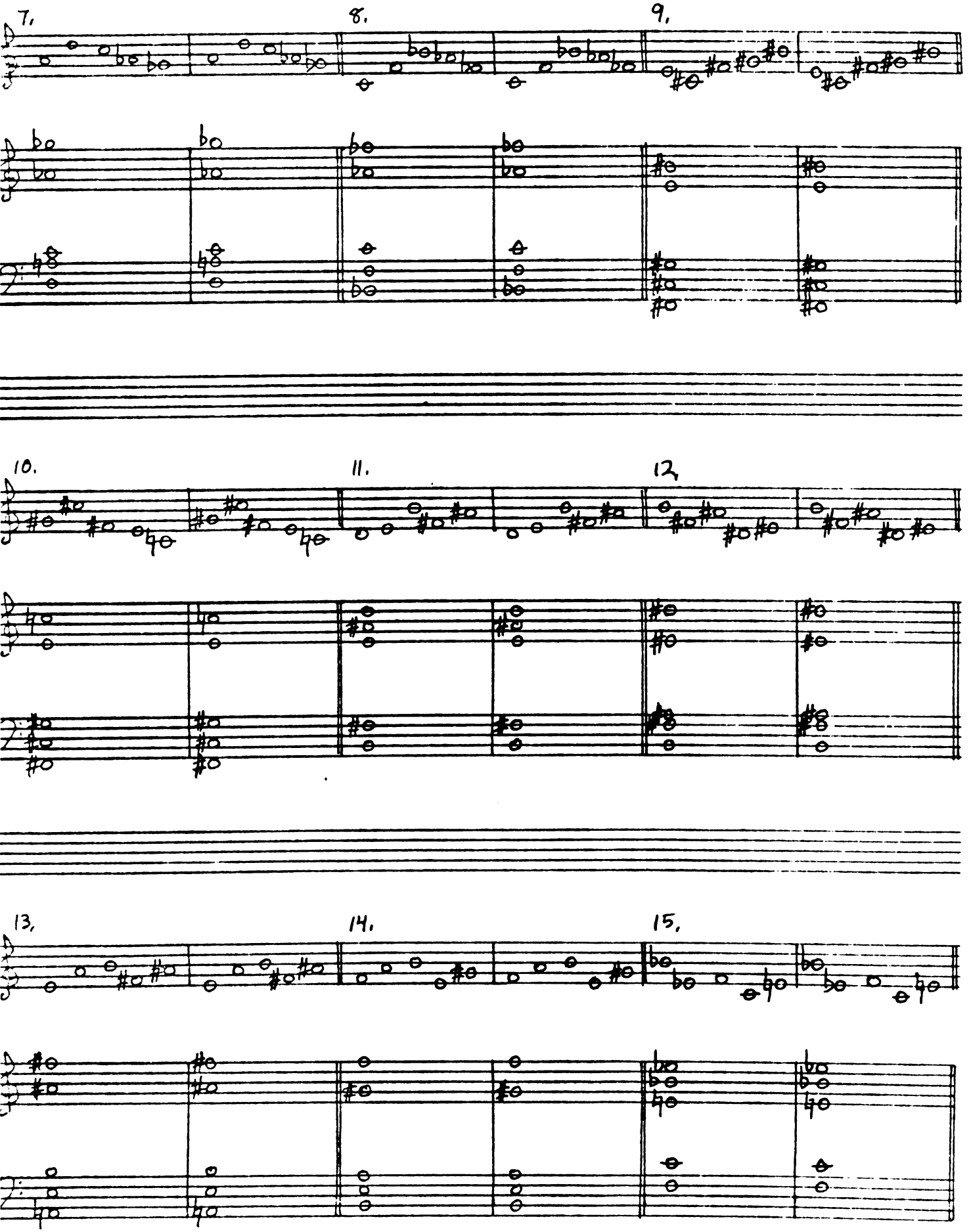
ATONAL SIGHT SINGING DRILLS

UNIT IX

Name Date

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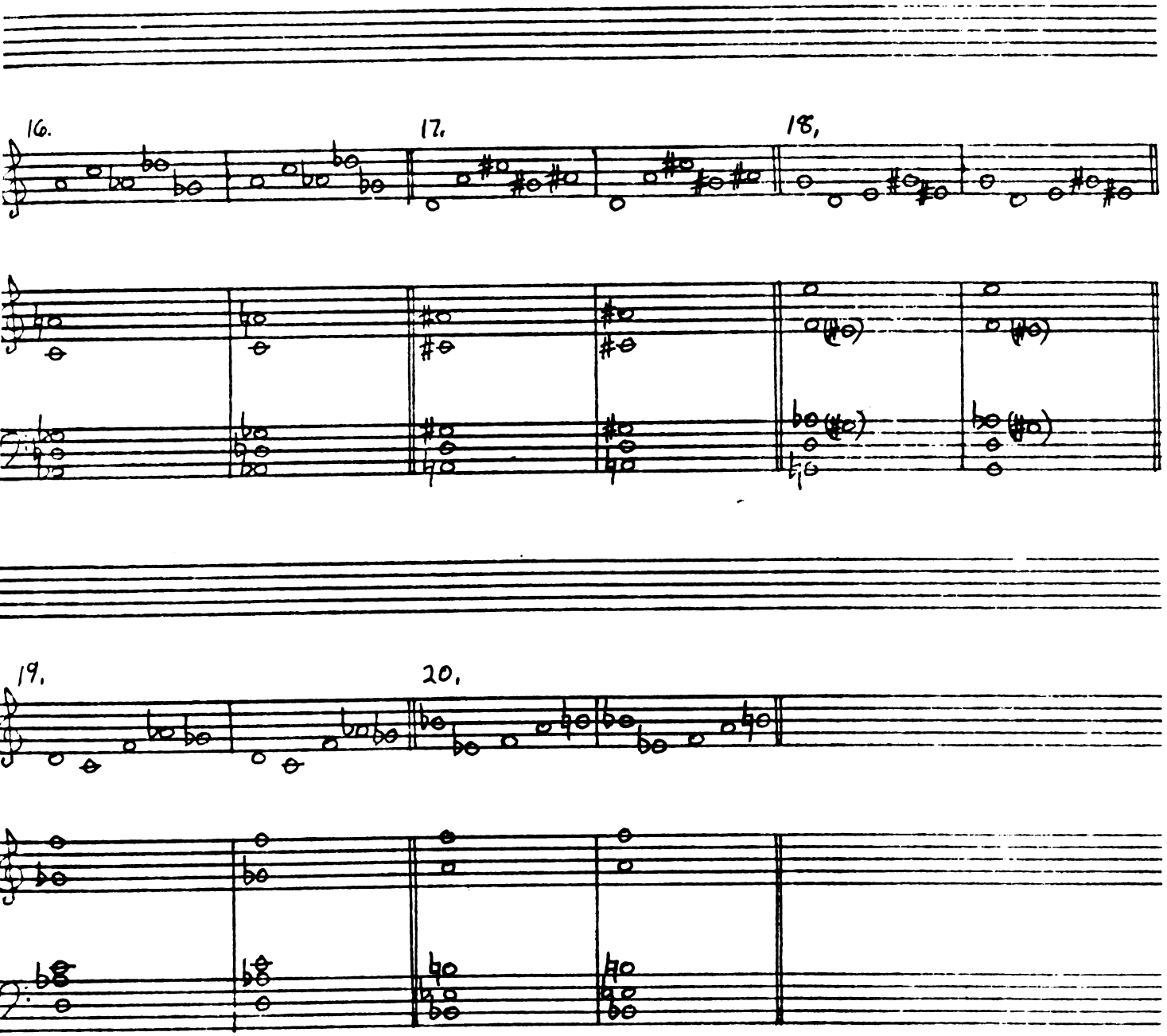
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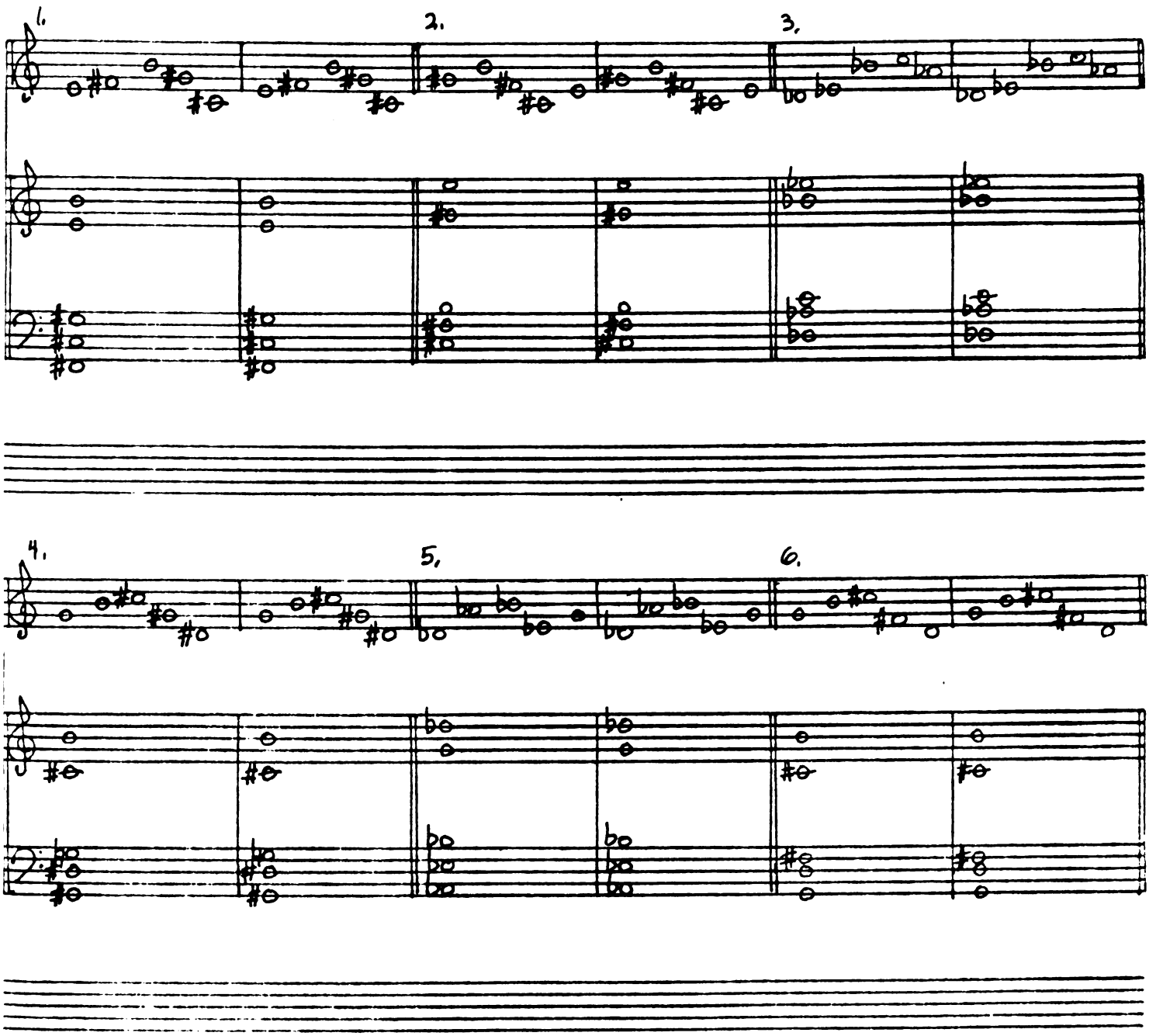
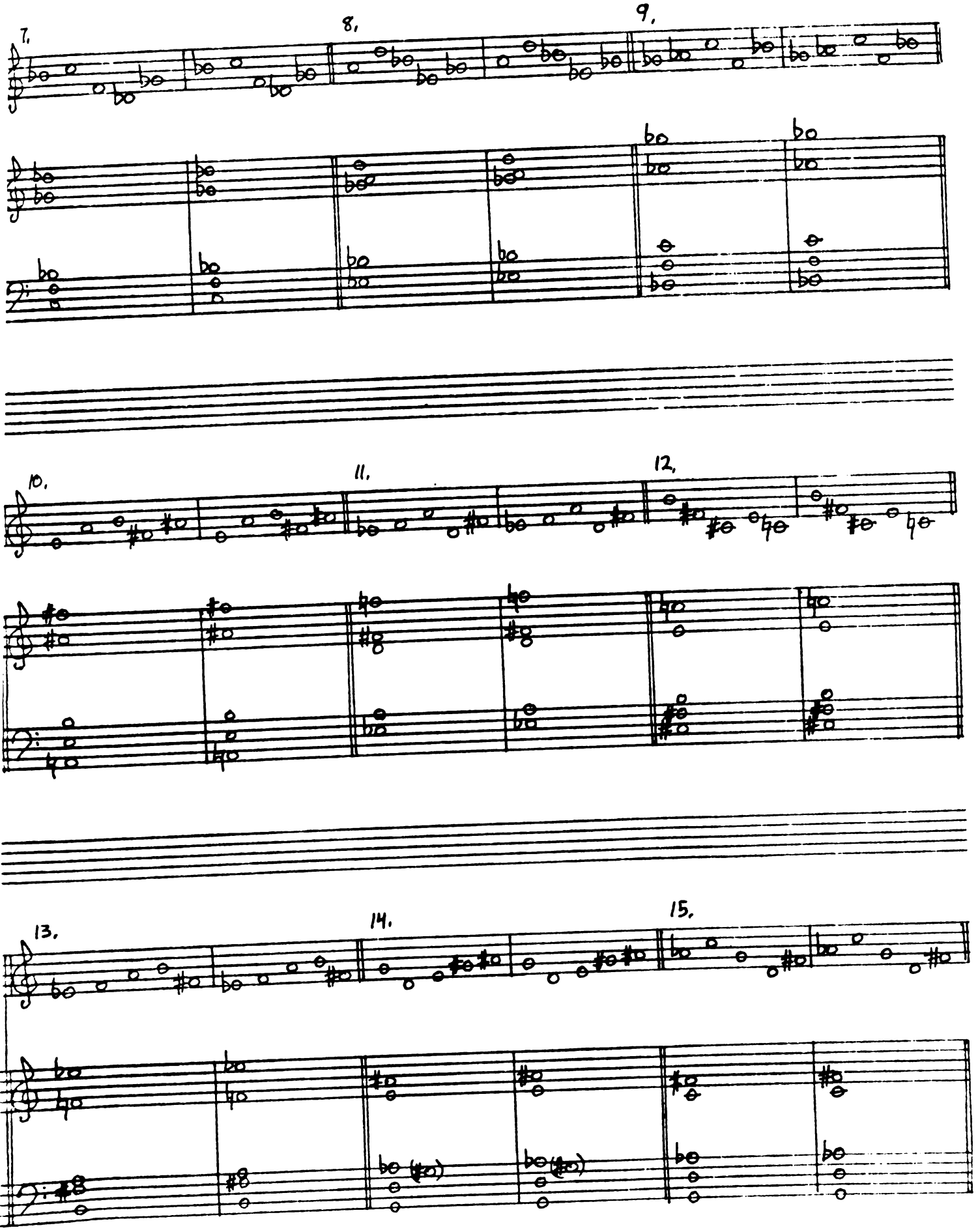
ATONAL SIGHT SINGING DRILLS

UNIT X

Name Date

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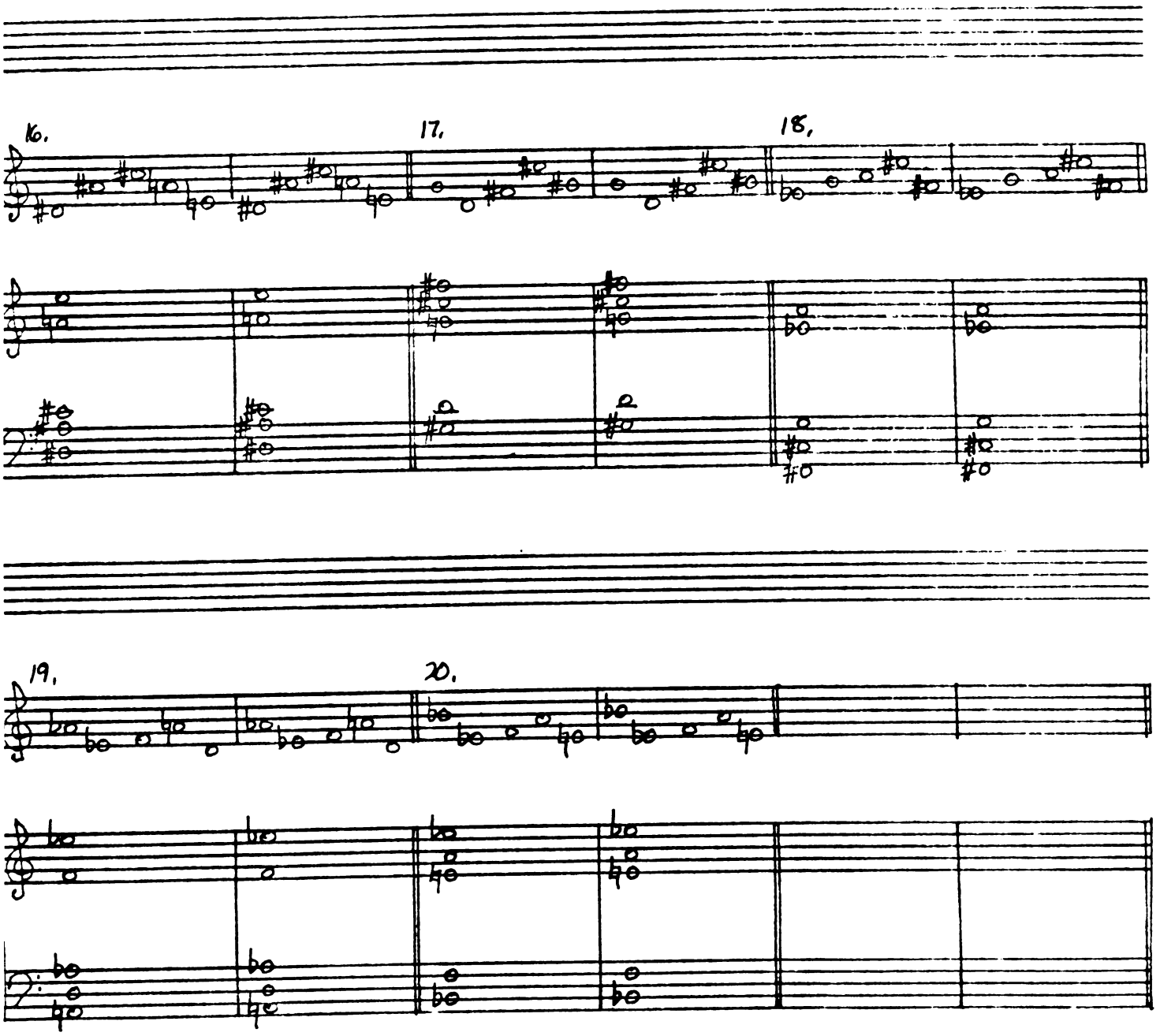
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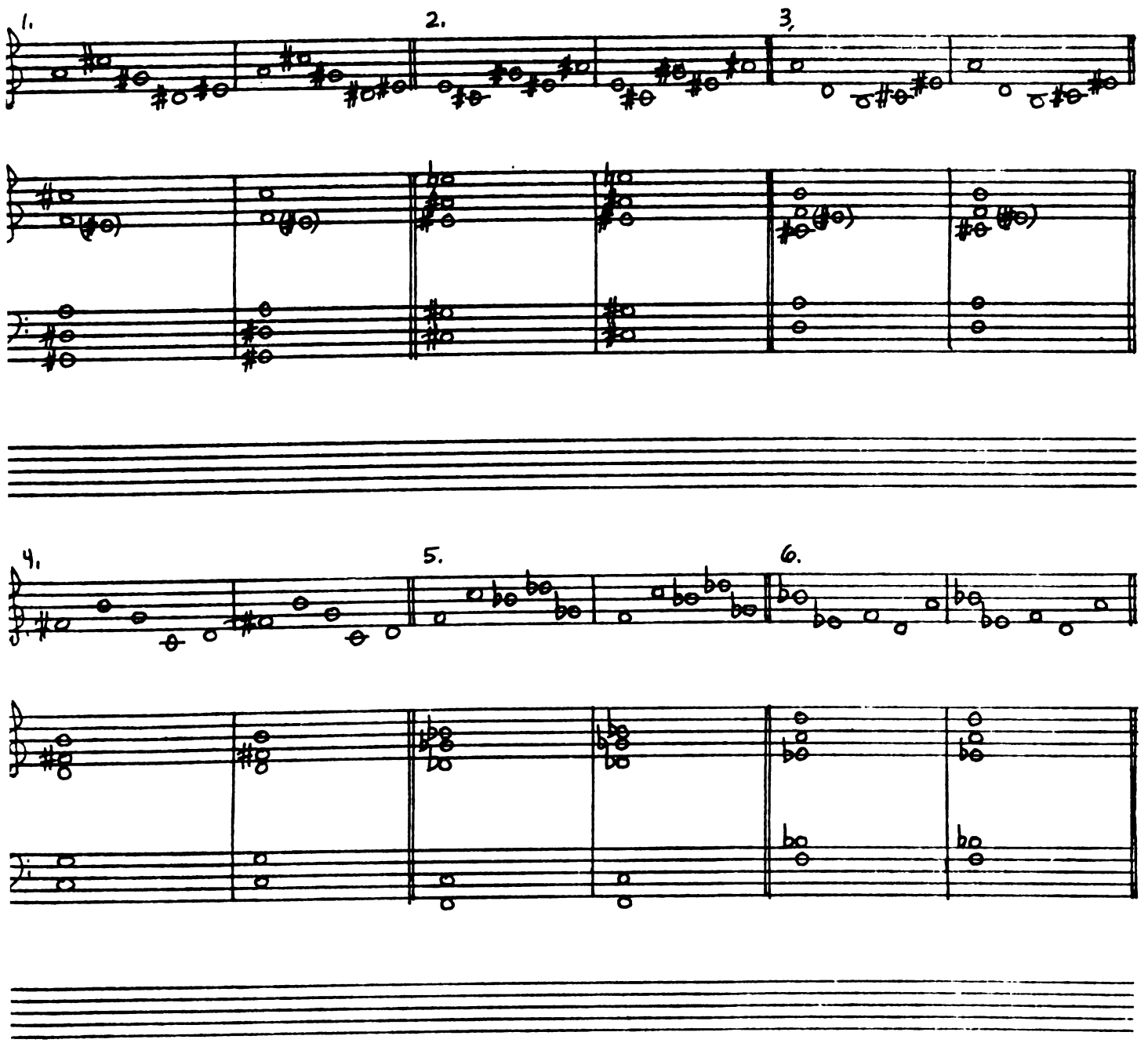
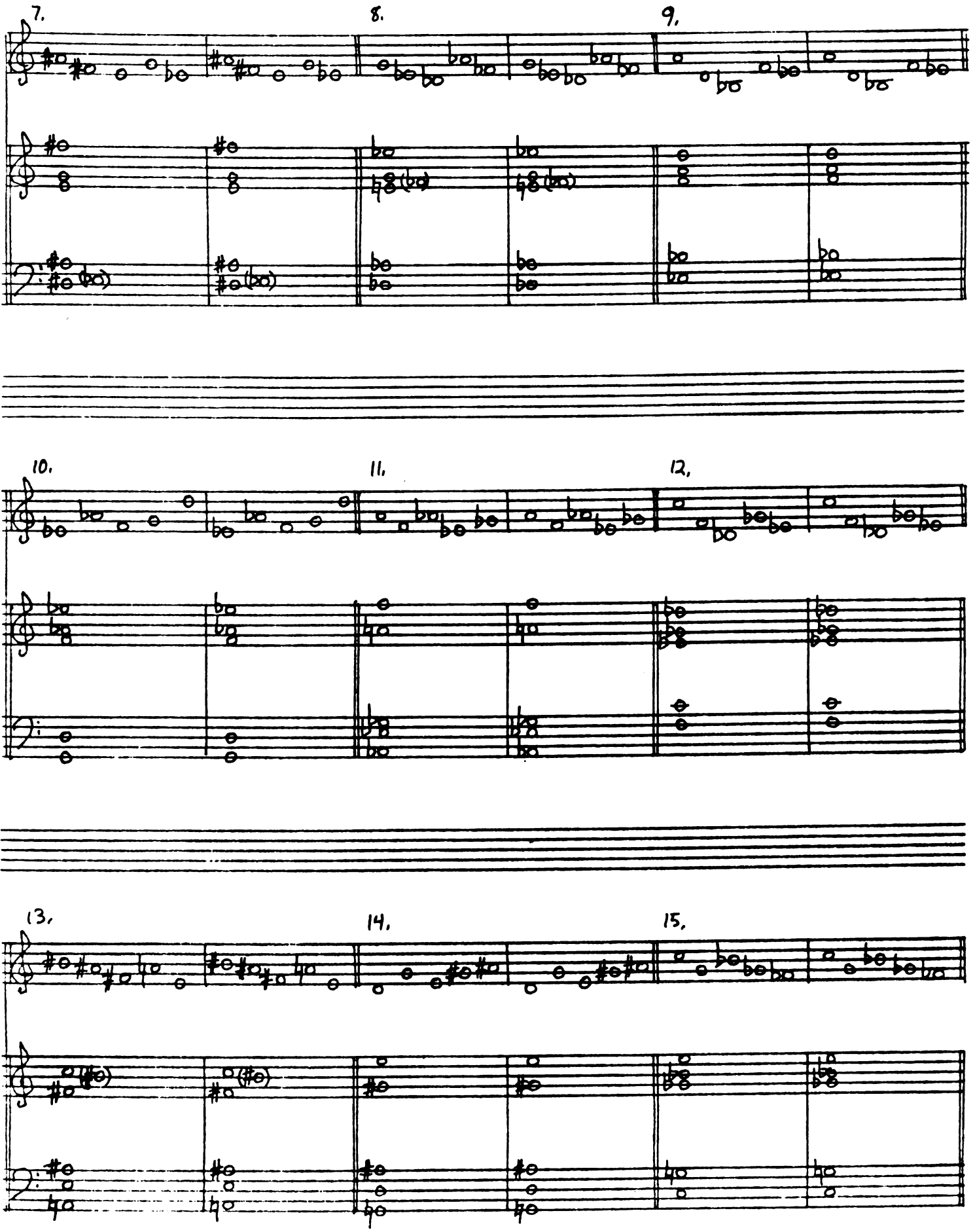
ATONAL SIGHT SINGING DRILLS

UNIT XI

Name

Date

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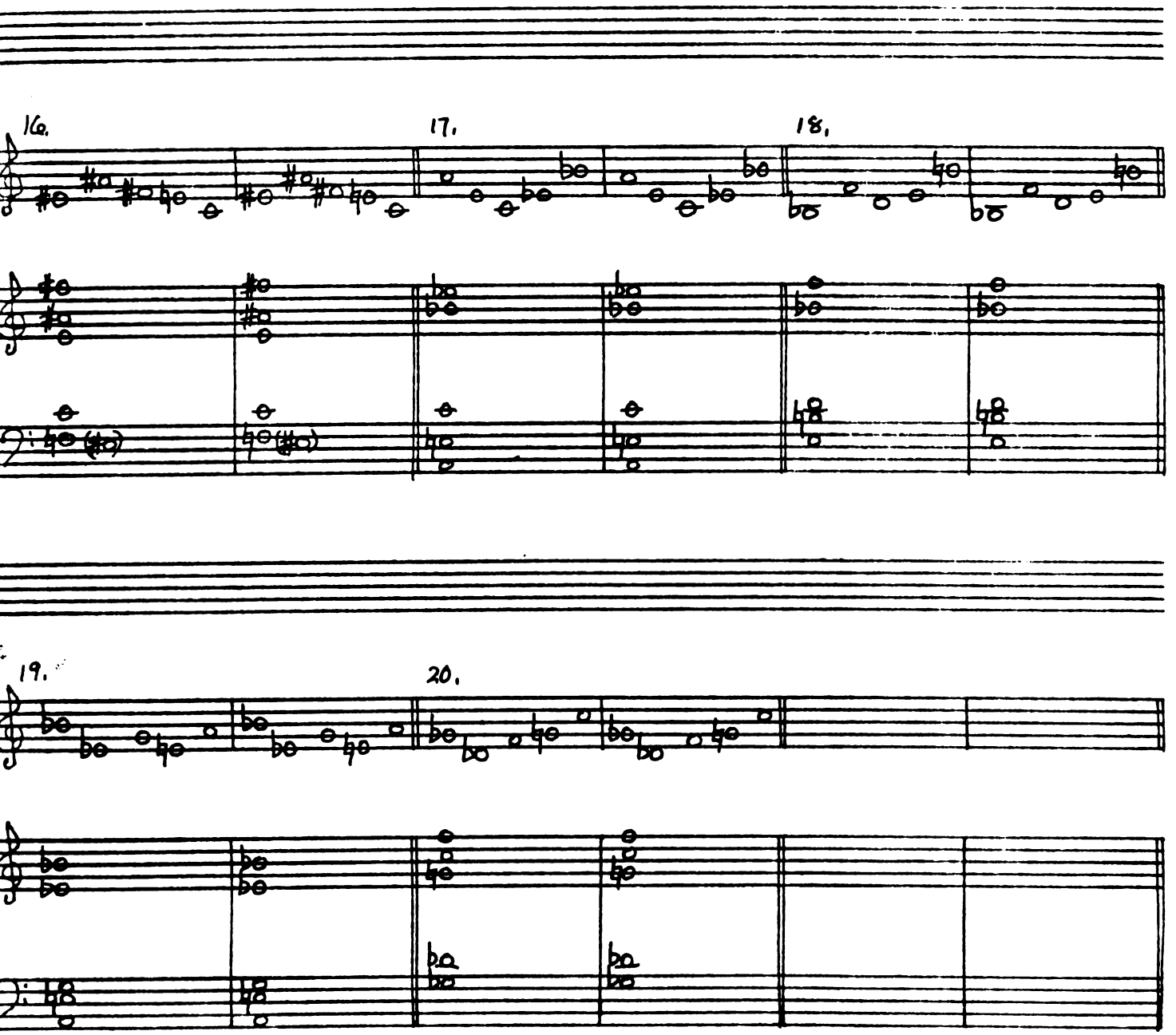
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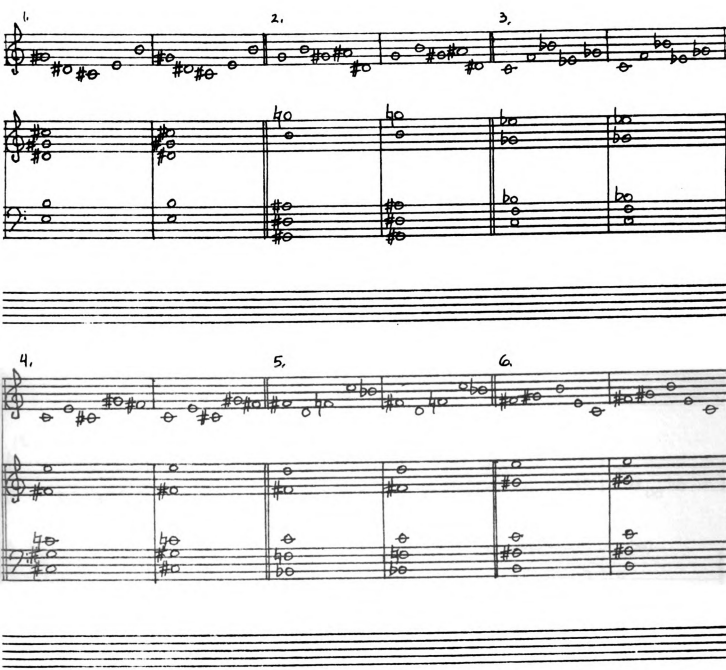
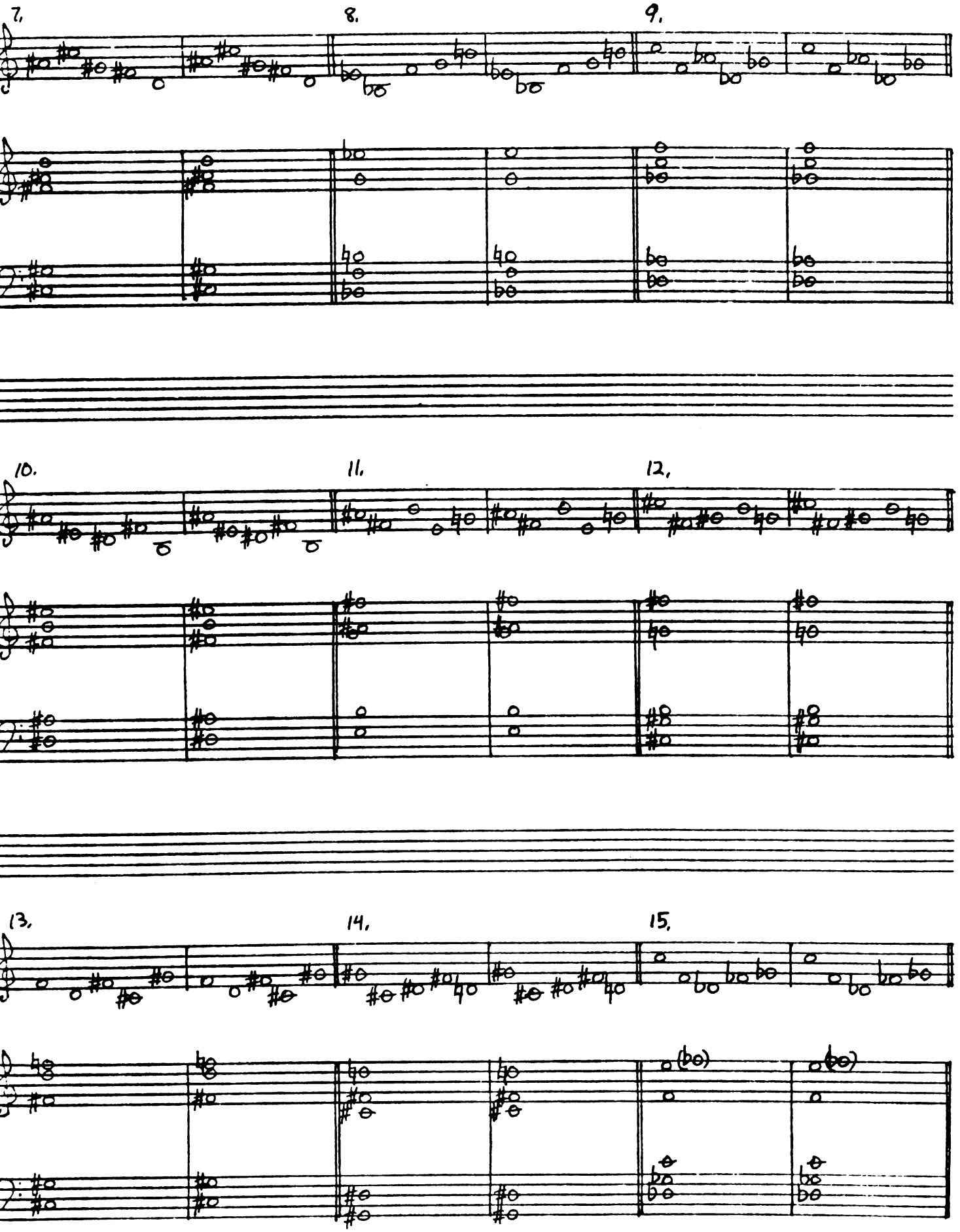
ATONAL SIGHT SINGING DRILLS

UNIT XII

Name

Date

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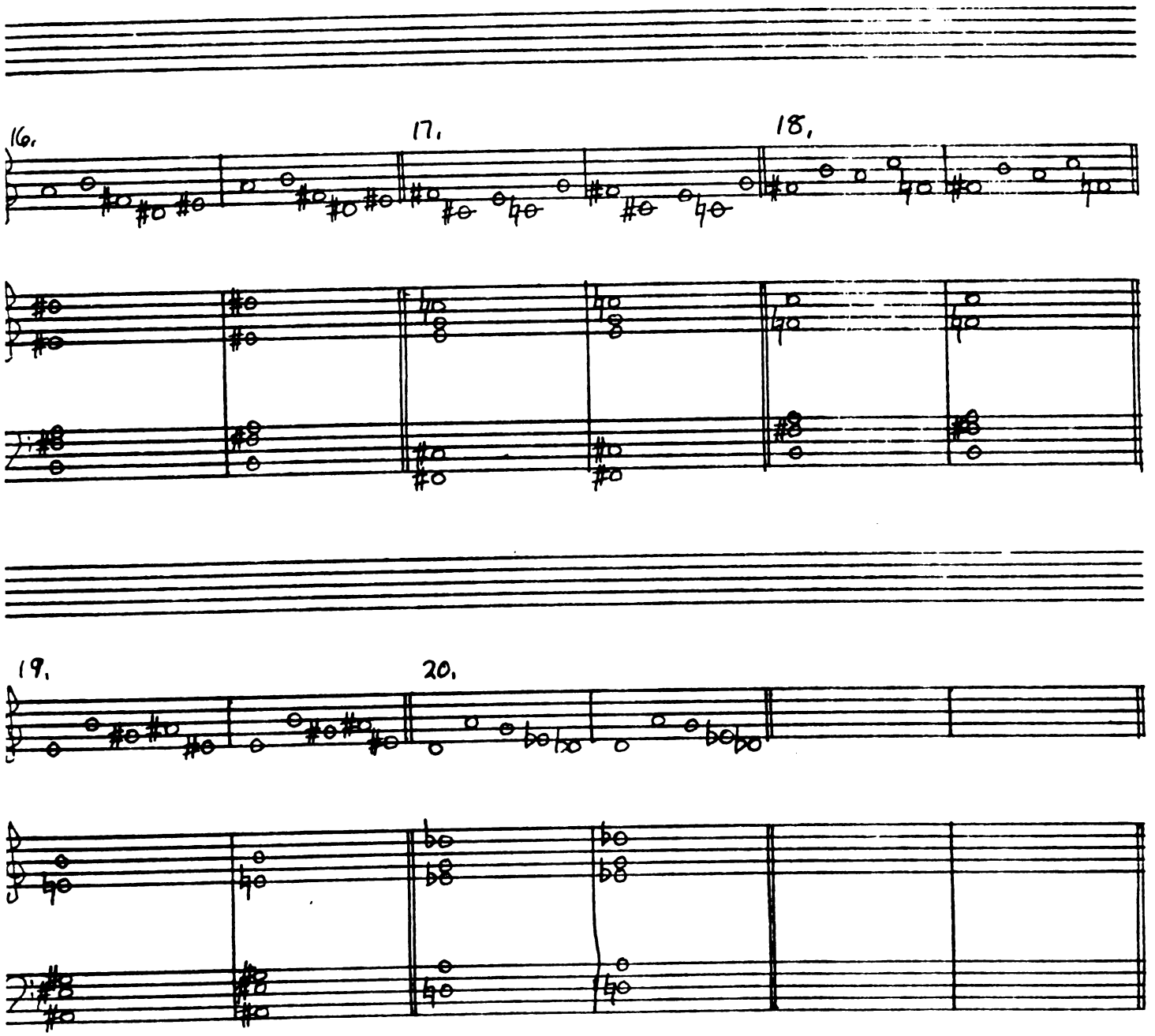
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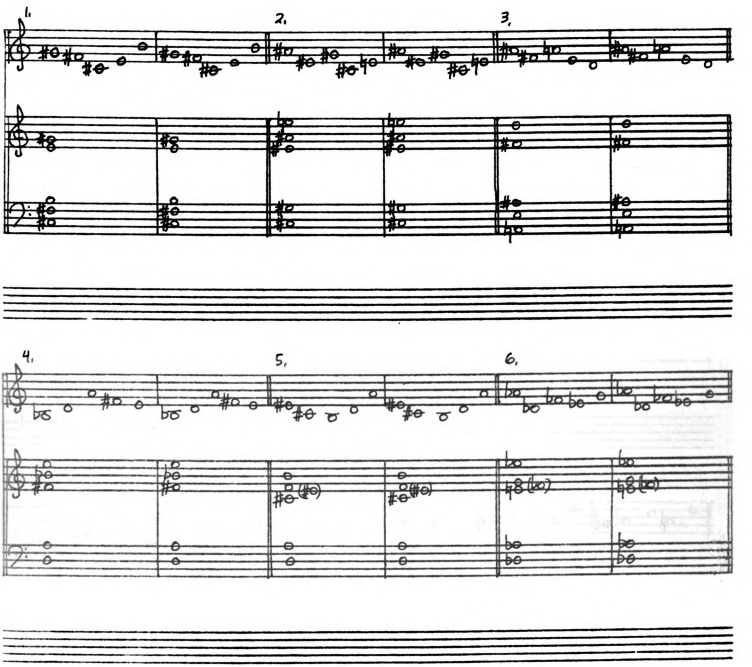
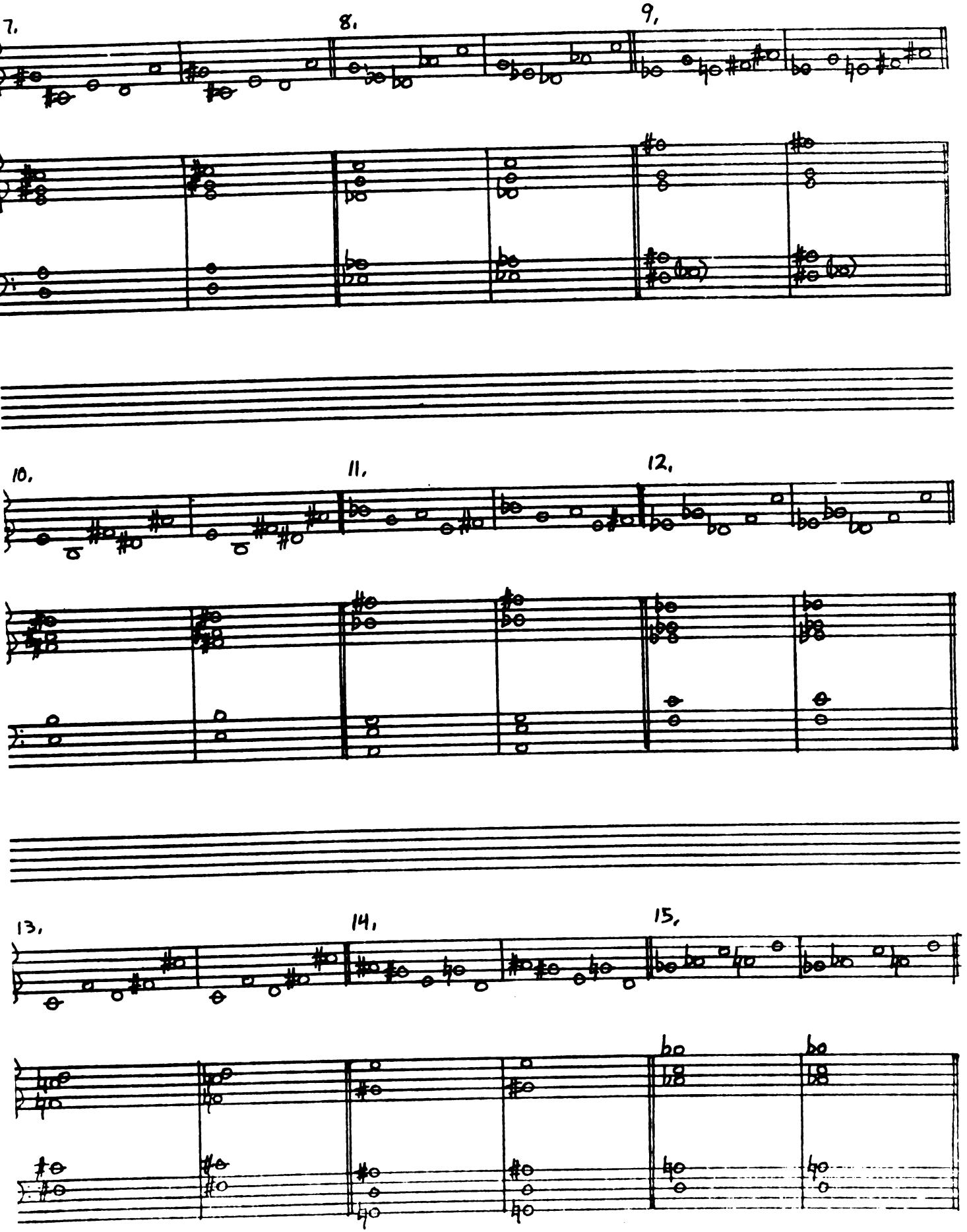
ATONAL SIGET SINGING DRILLS

UNIT XIII

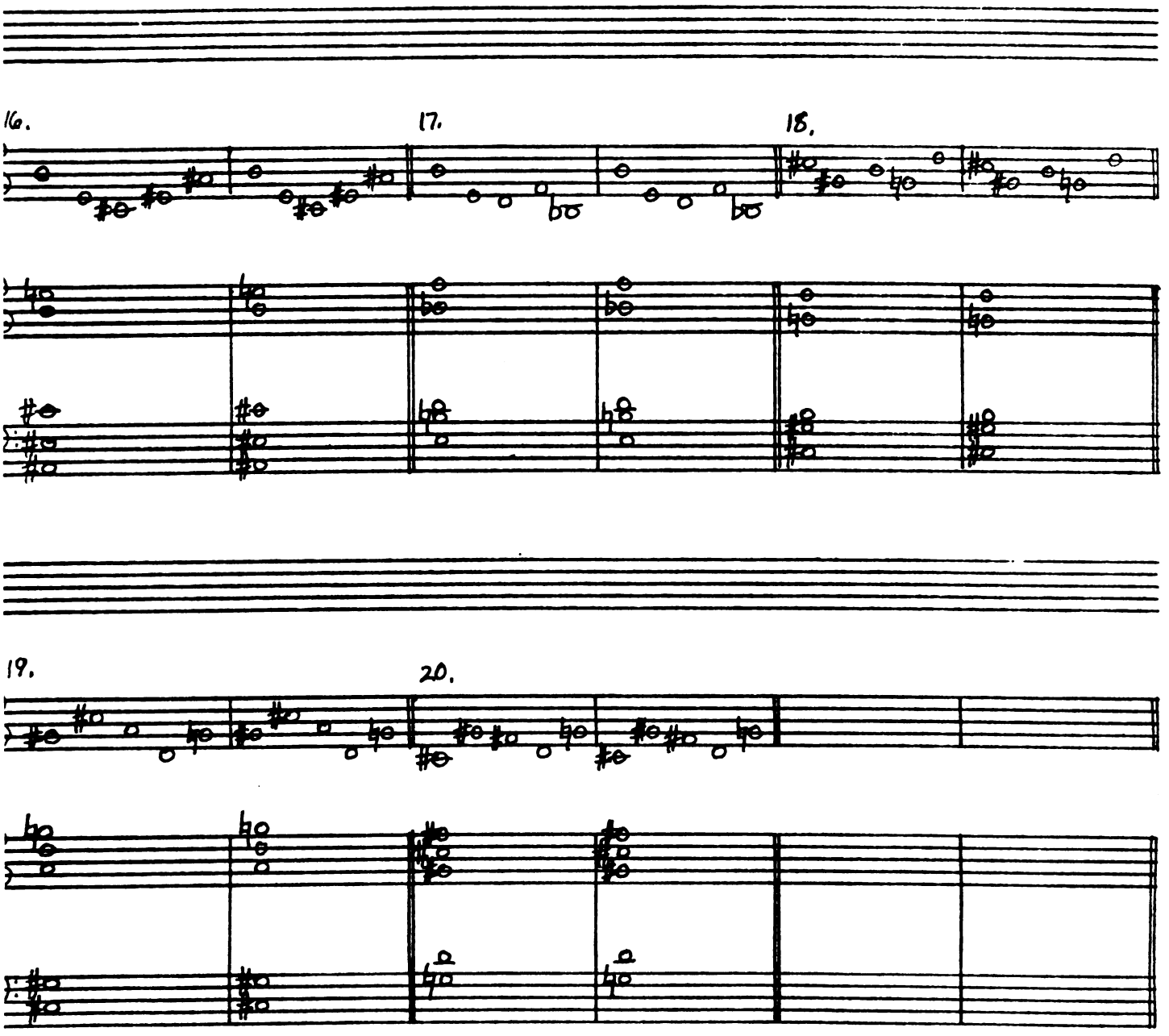
Name Date



XIII - 2



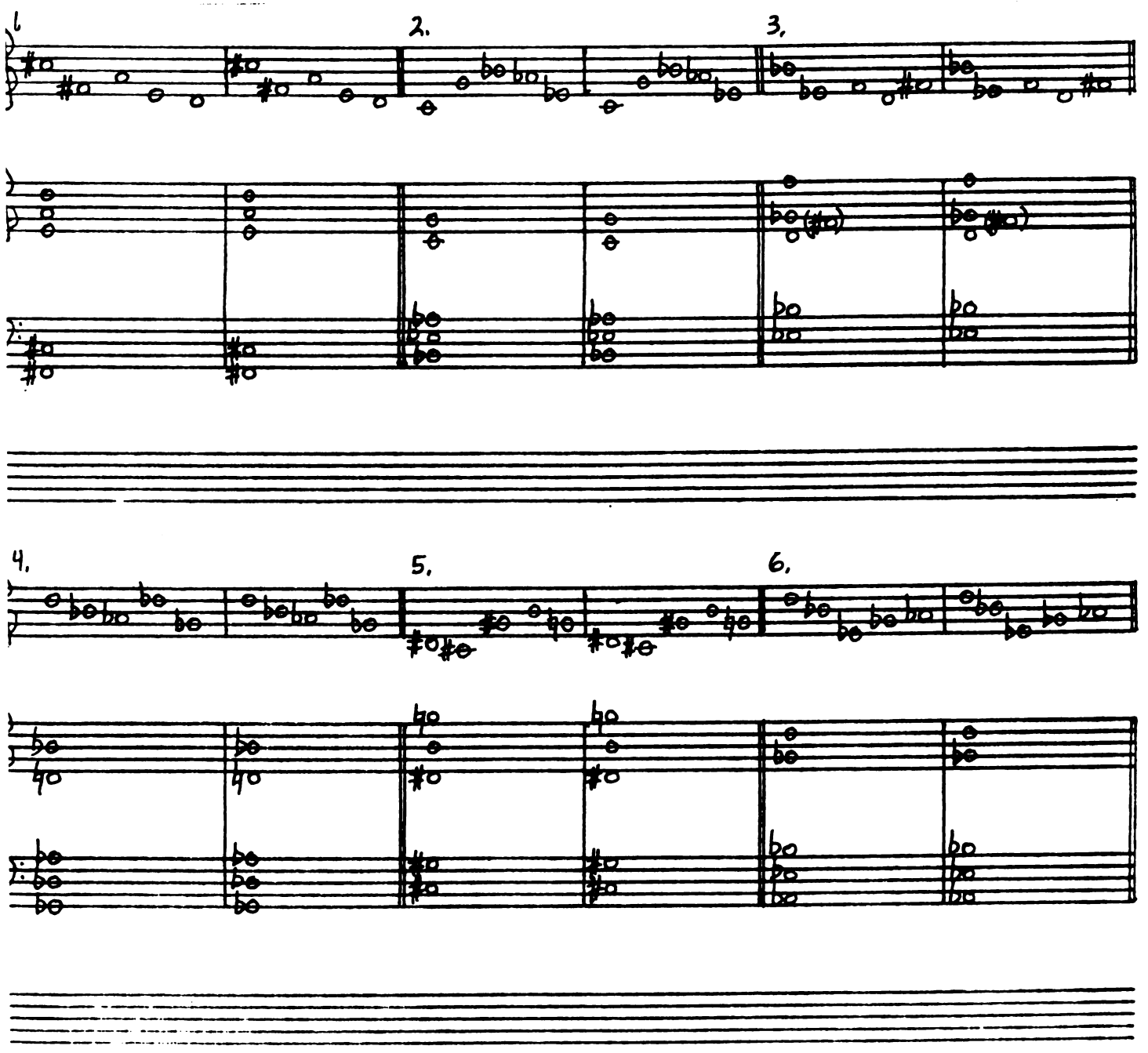
XIII - 3



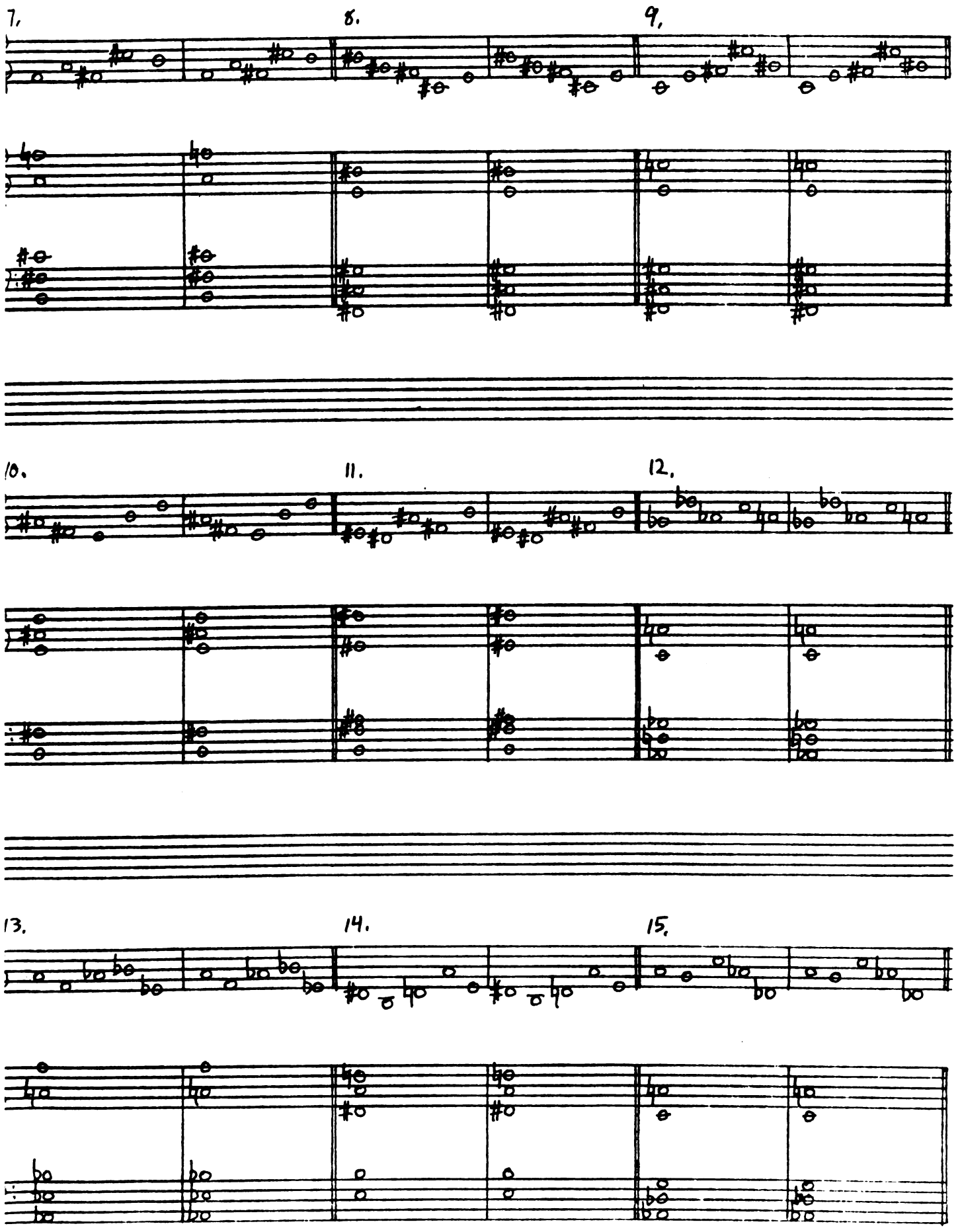
ATONAL SIGHT SINGING DRILLS

UNIT XIV

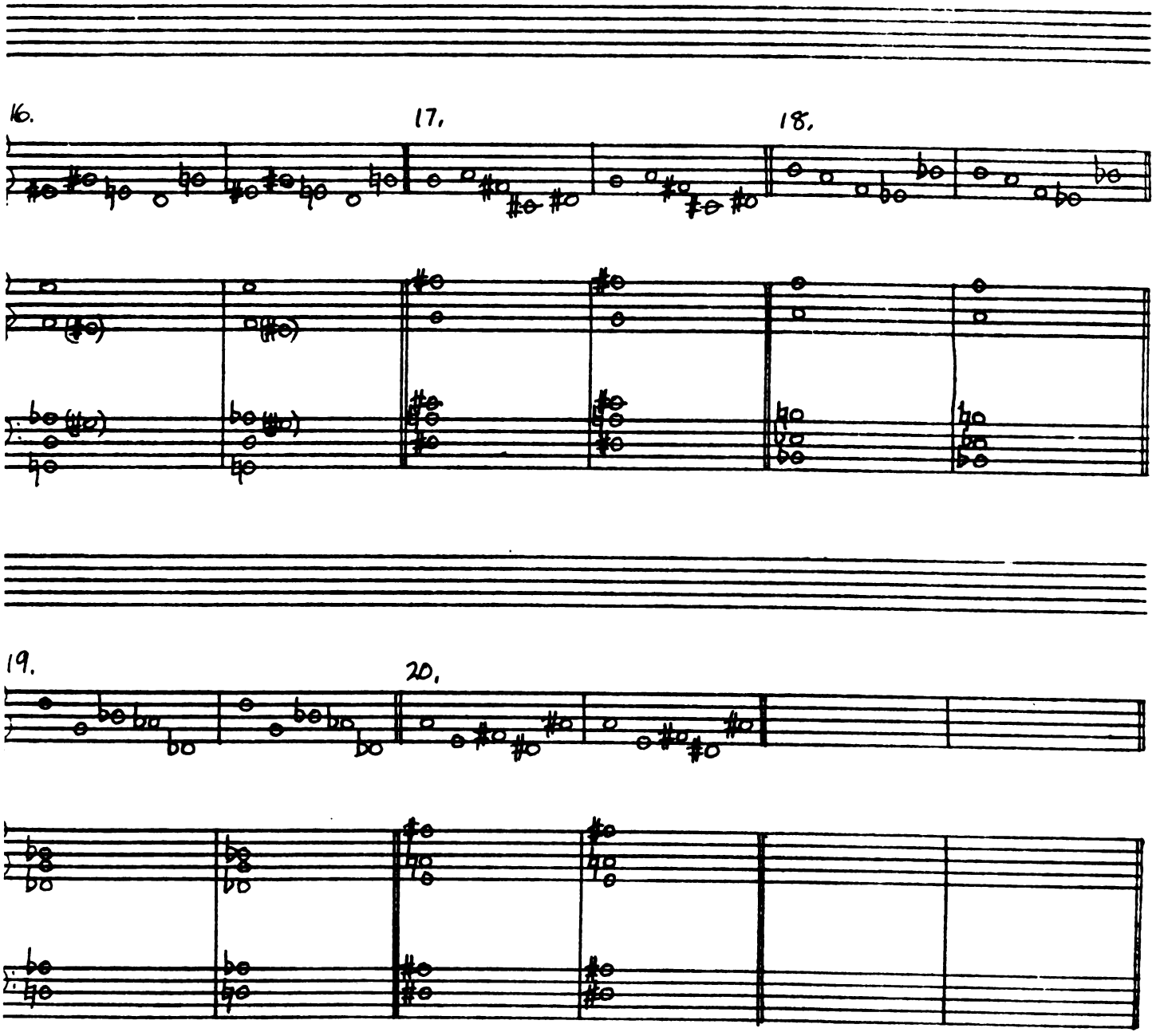
Name Date



XIV - 2



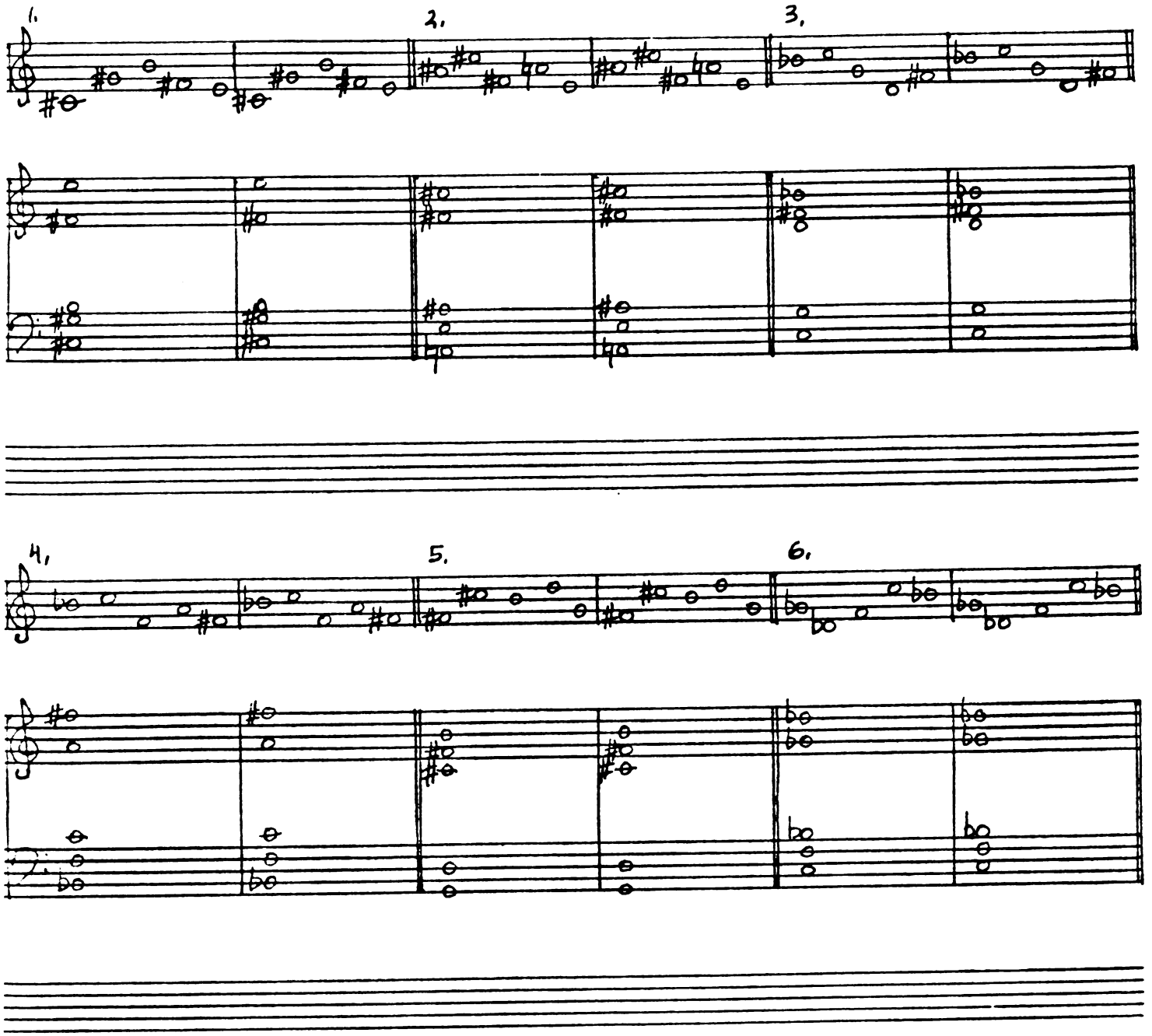
XIV - 3

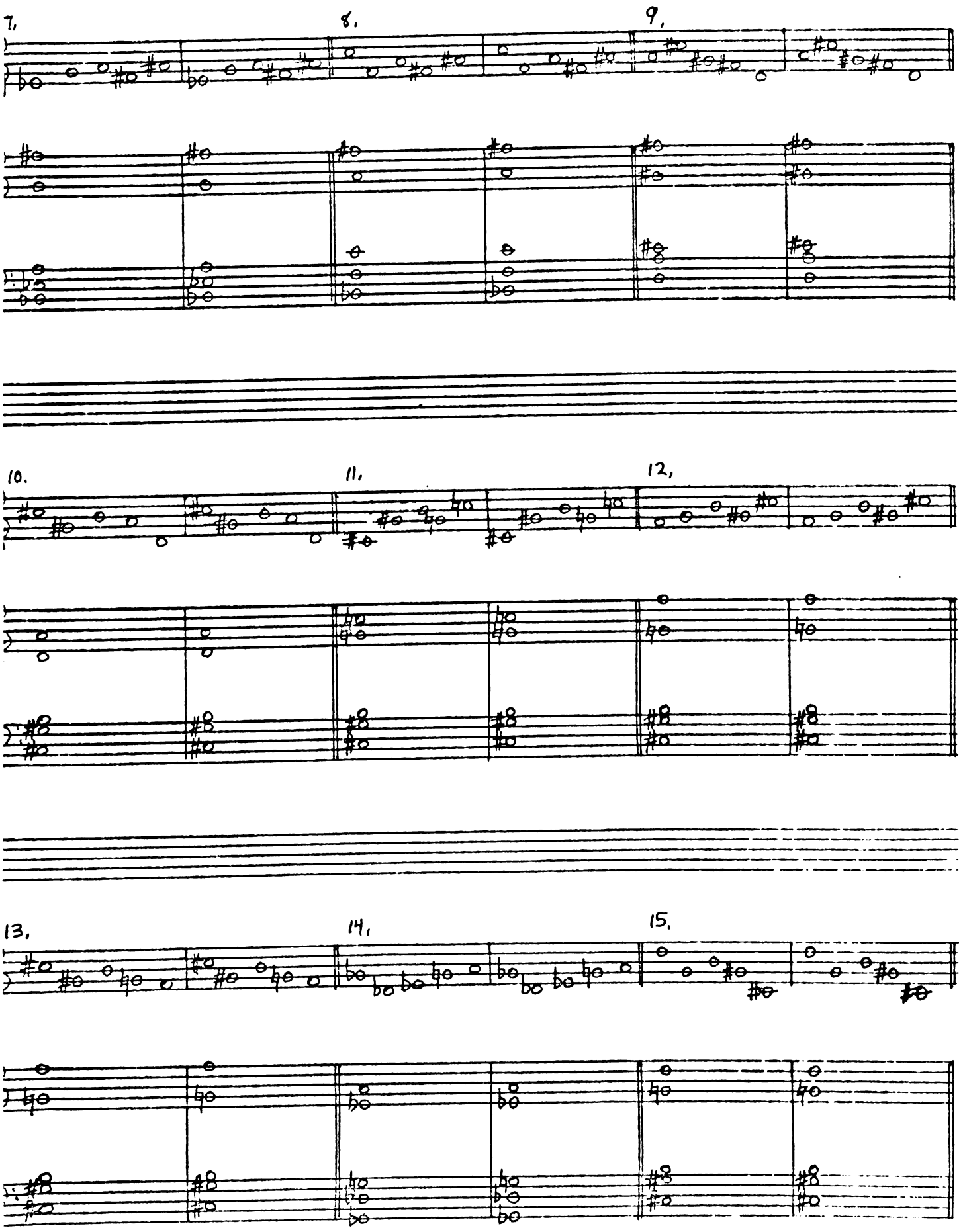


ATONAL SIGHT SINGING DRILLS

UNIT XV

Name Date

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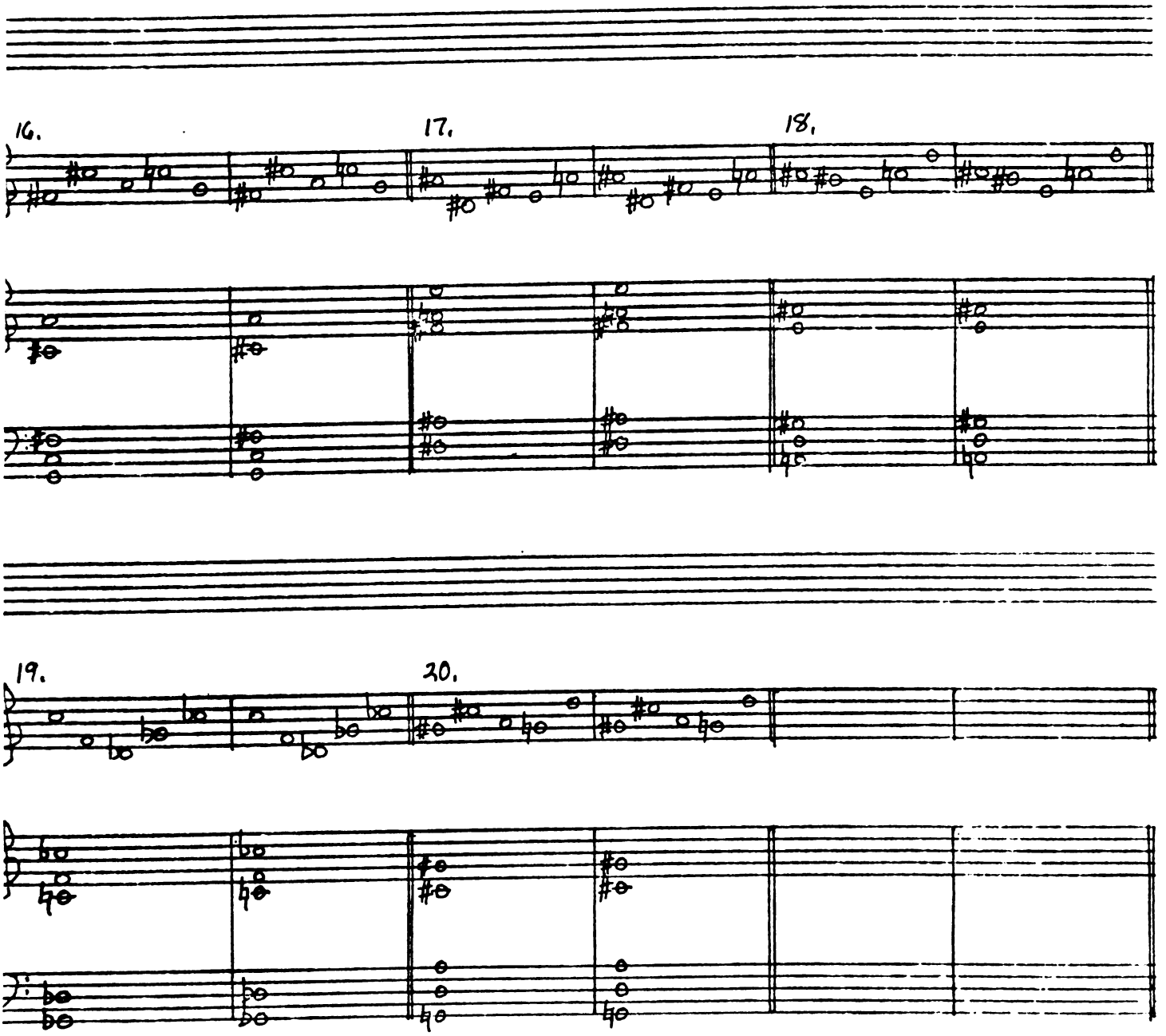
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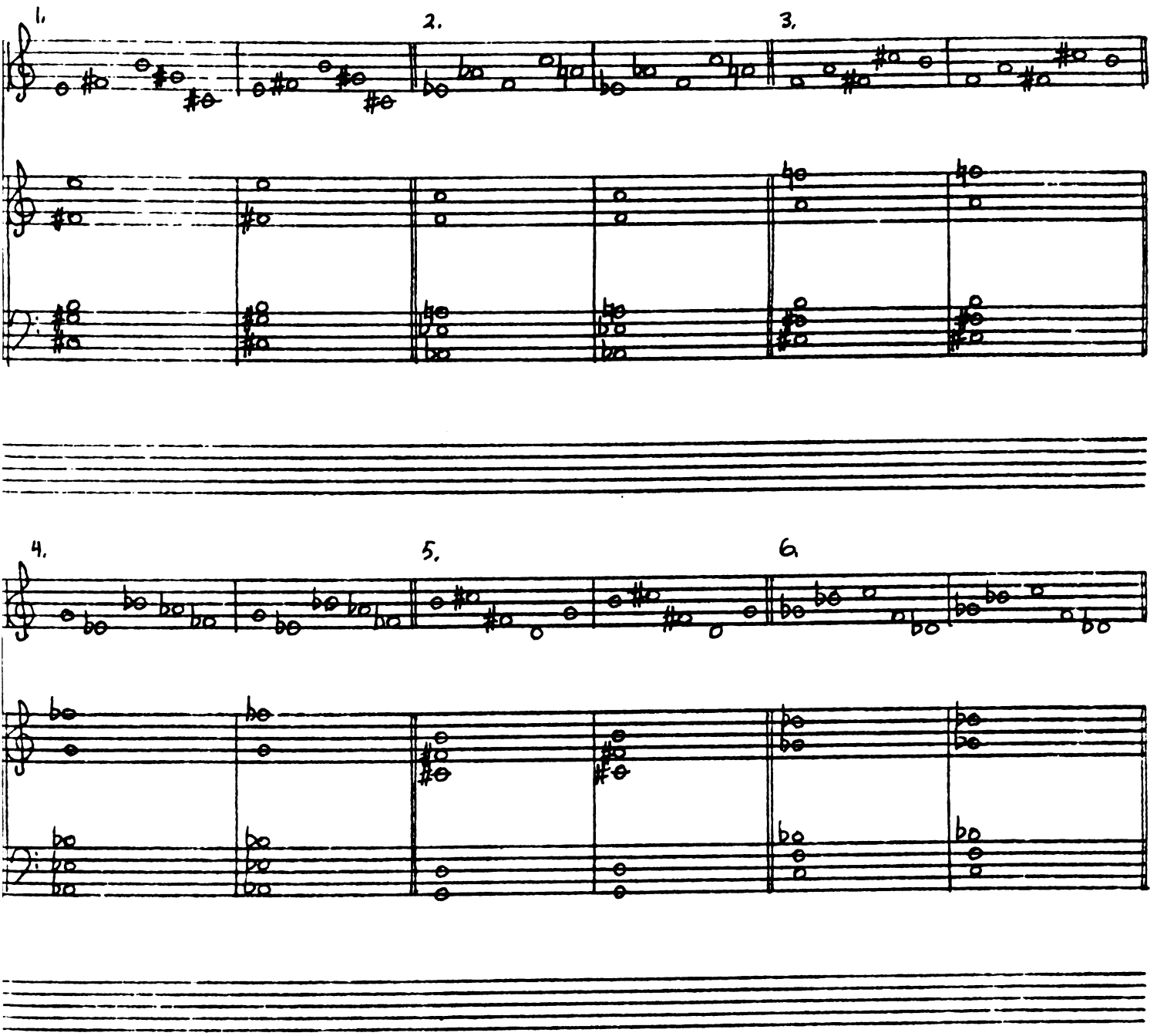
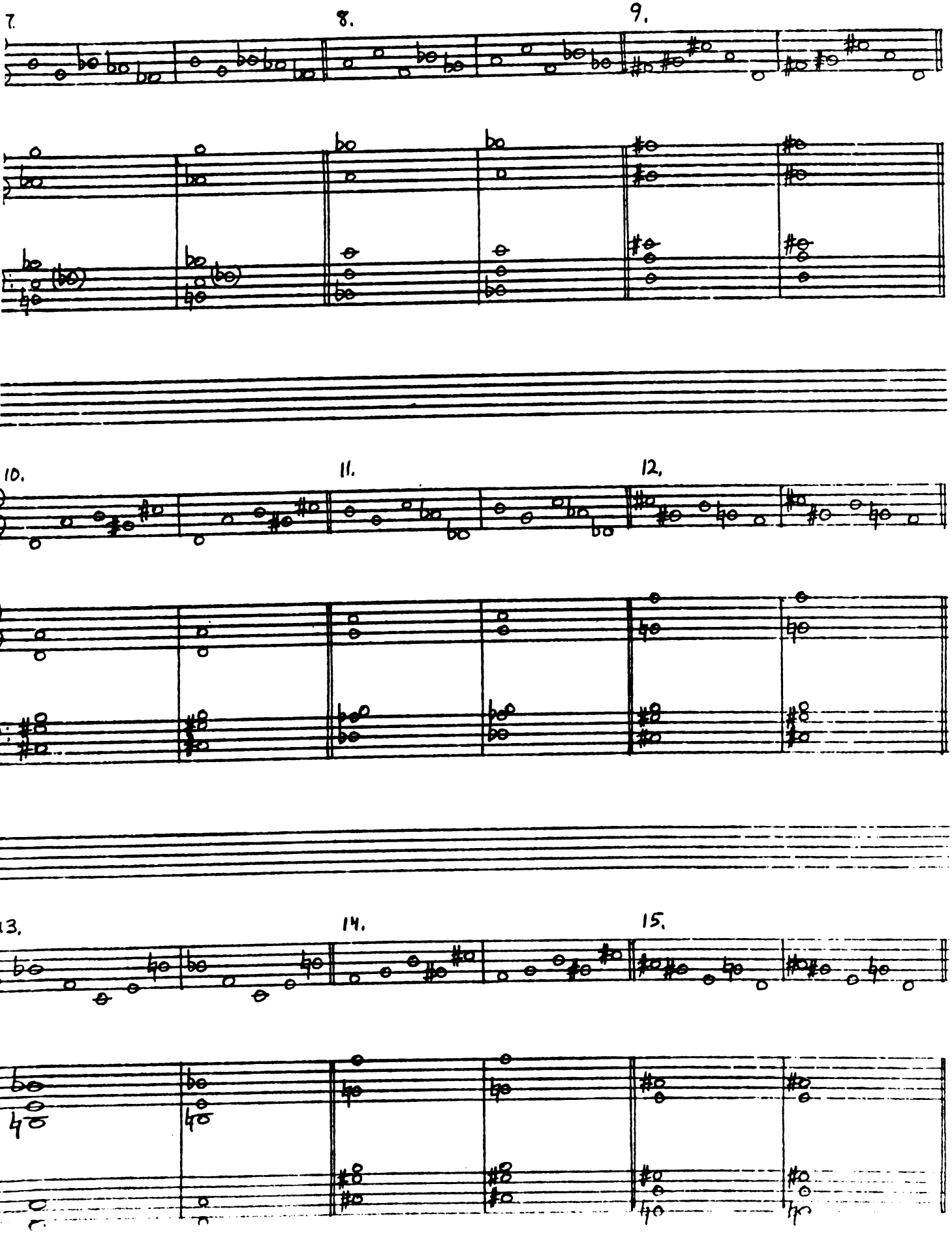
ATONAL SIGHT SINGING DRILLS

UNIT XVI

Name

Date

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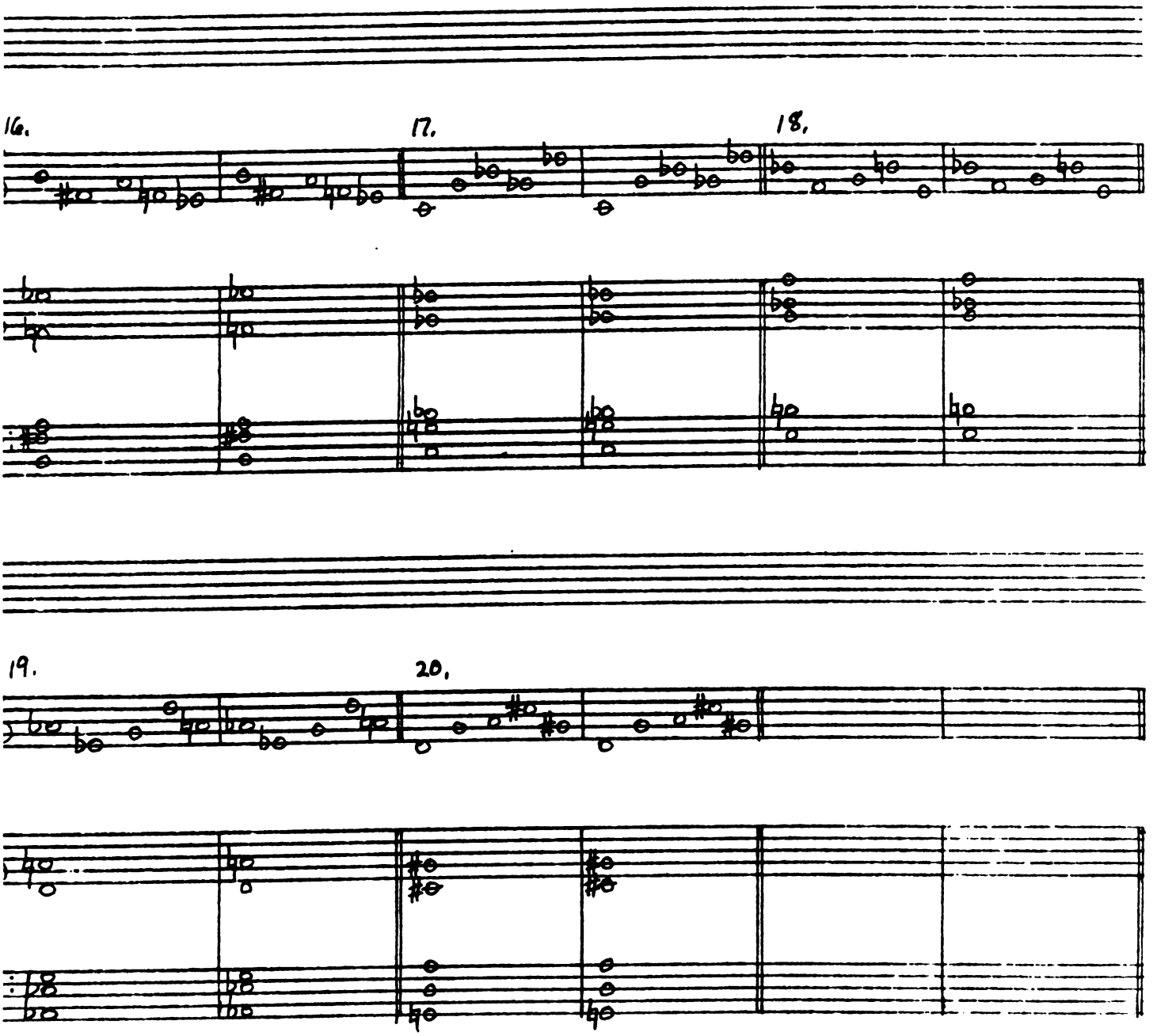
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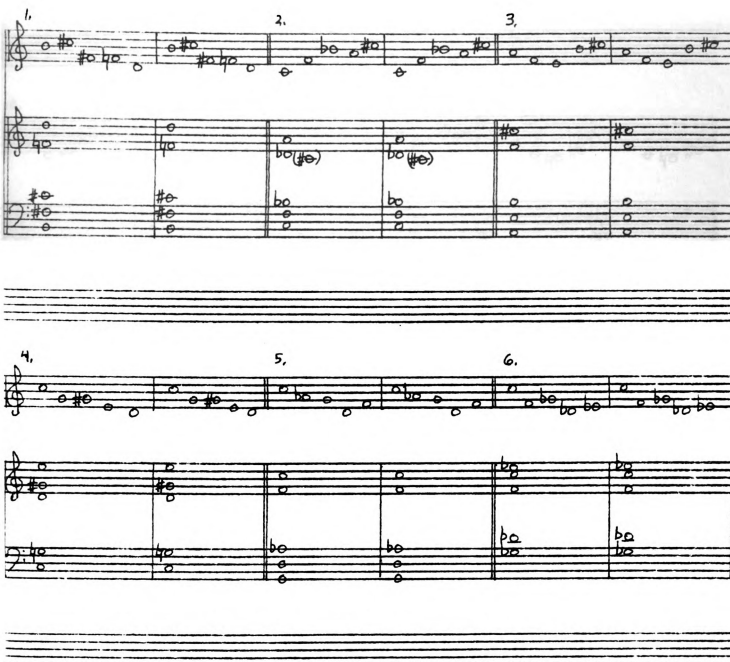
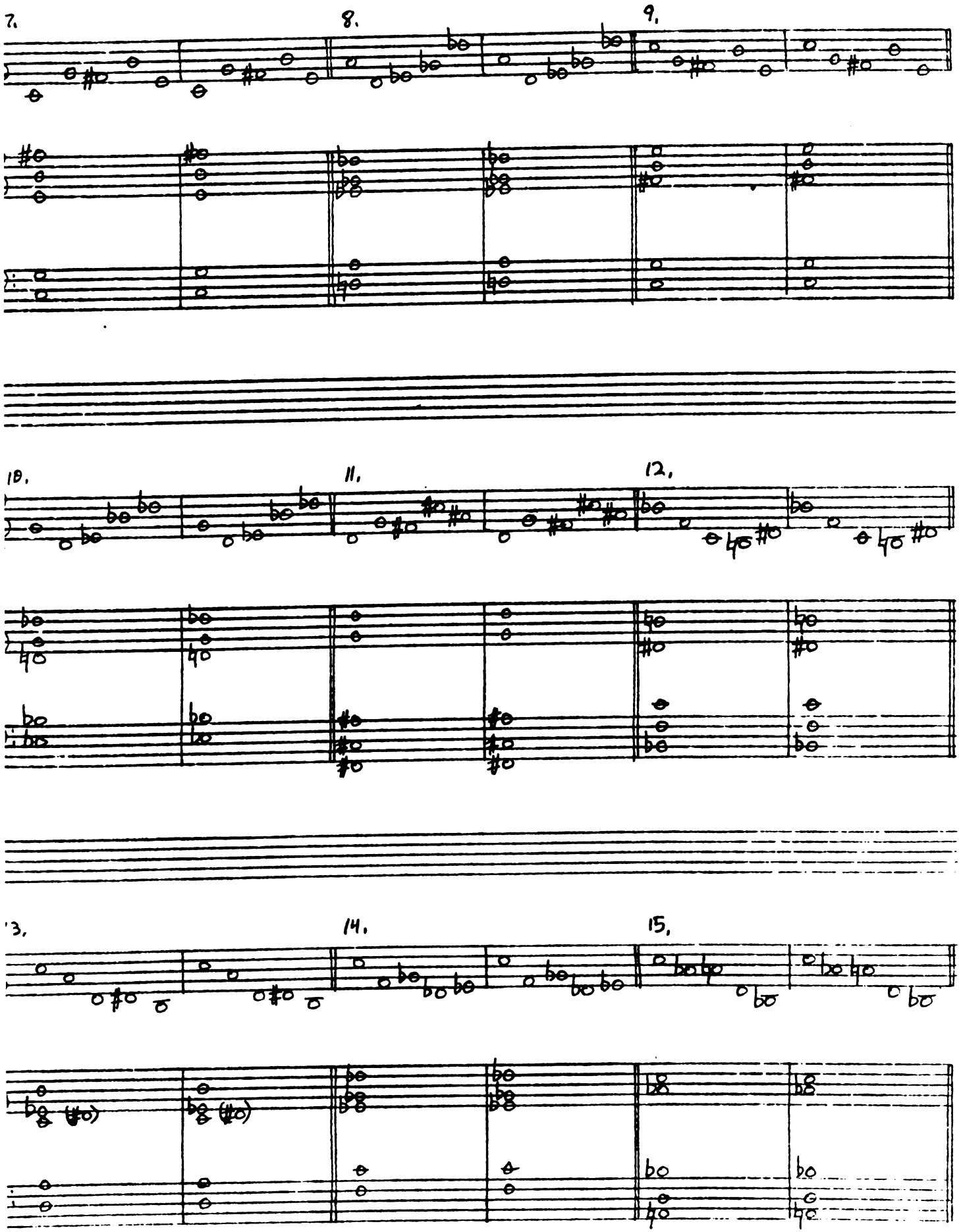
UNIT XVII

Name Date

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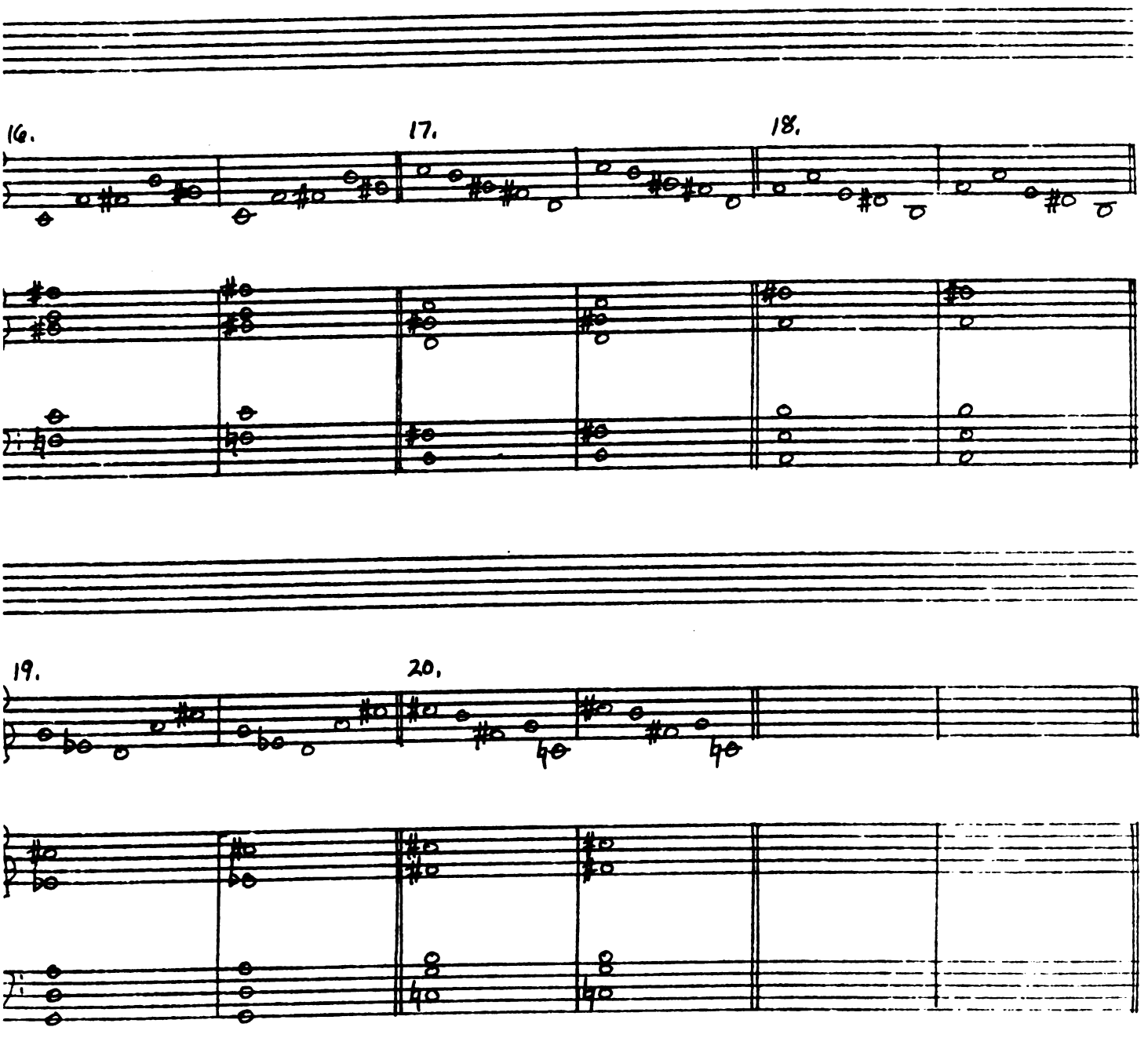
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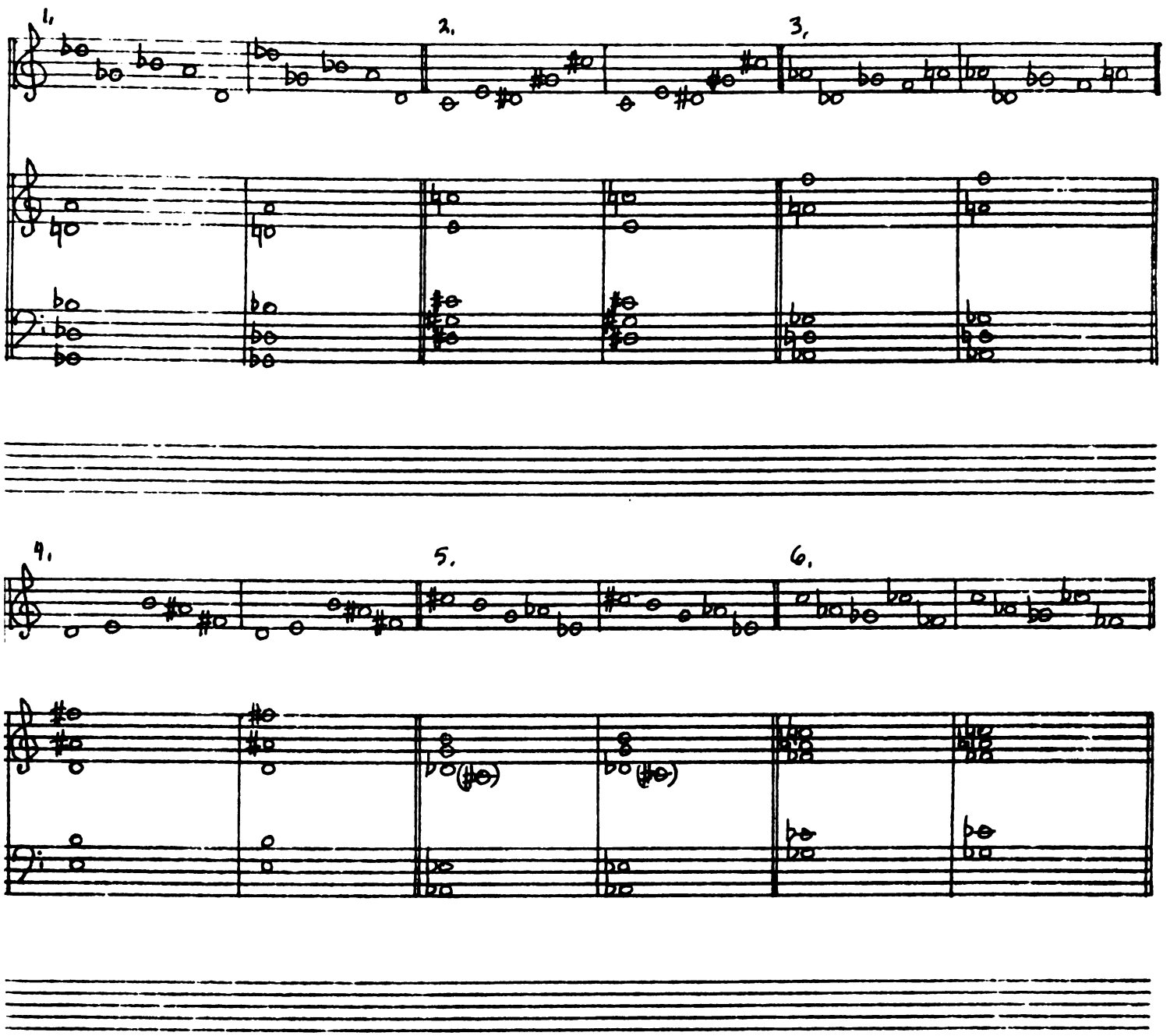
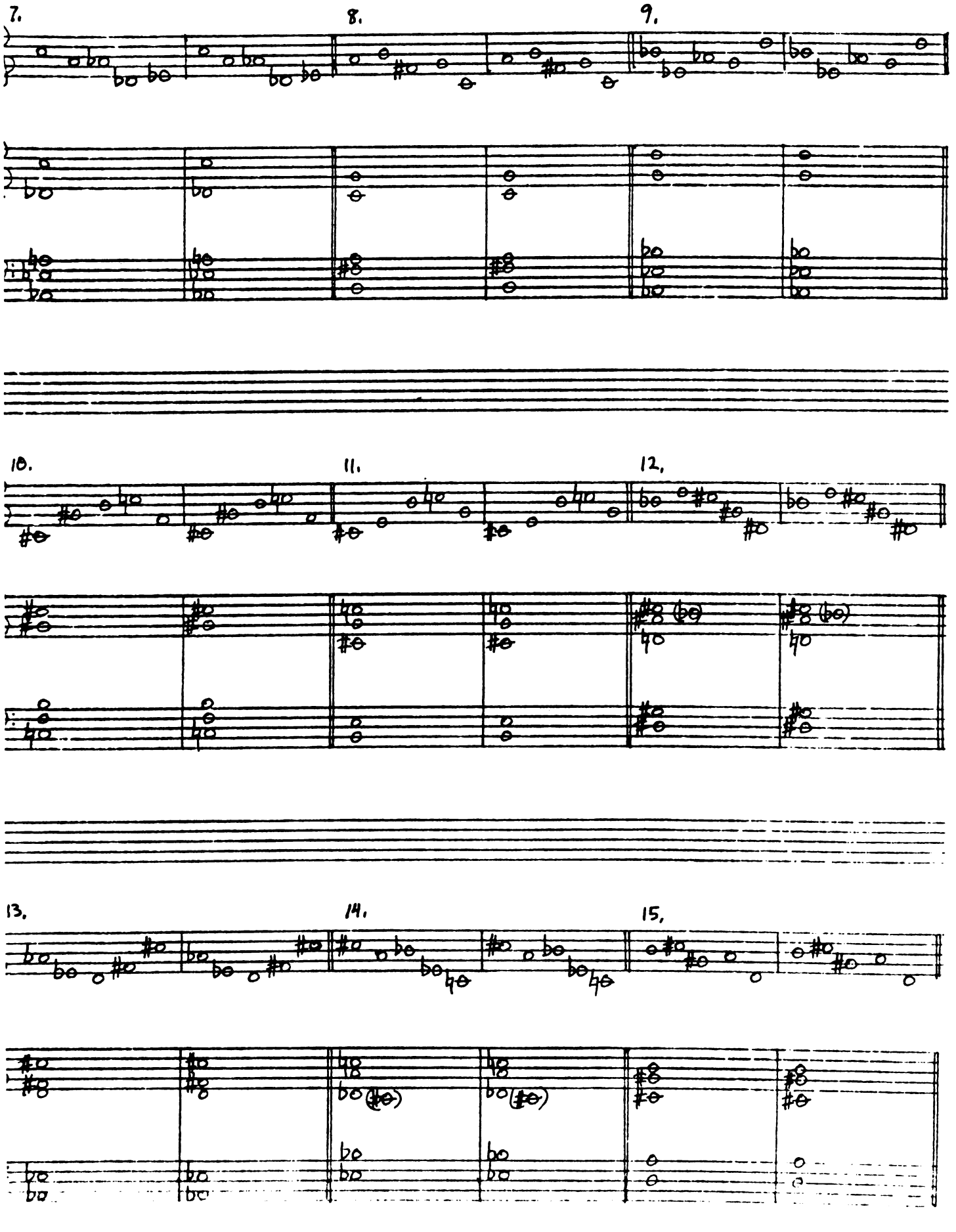
ATONAL SIGHT SINGING DRILLS

UNIT XVIII

Name

Date

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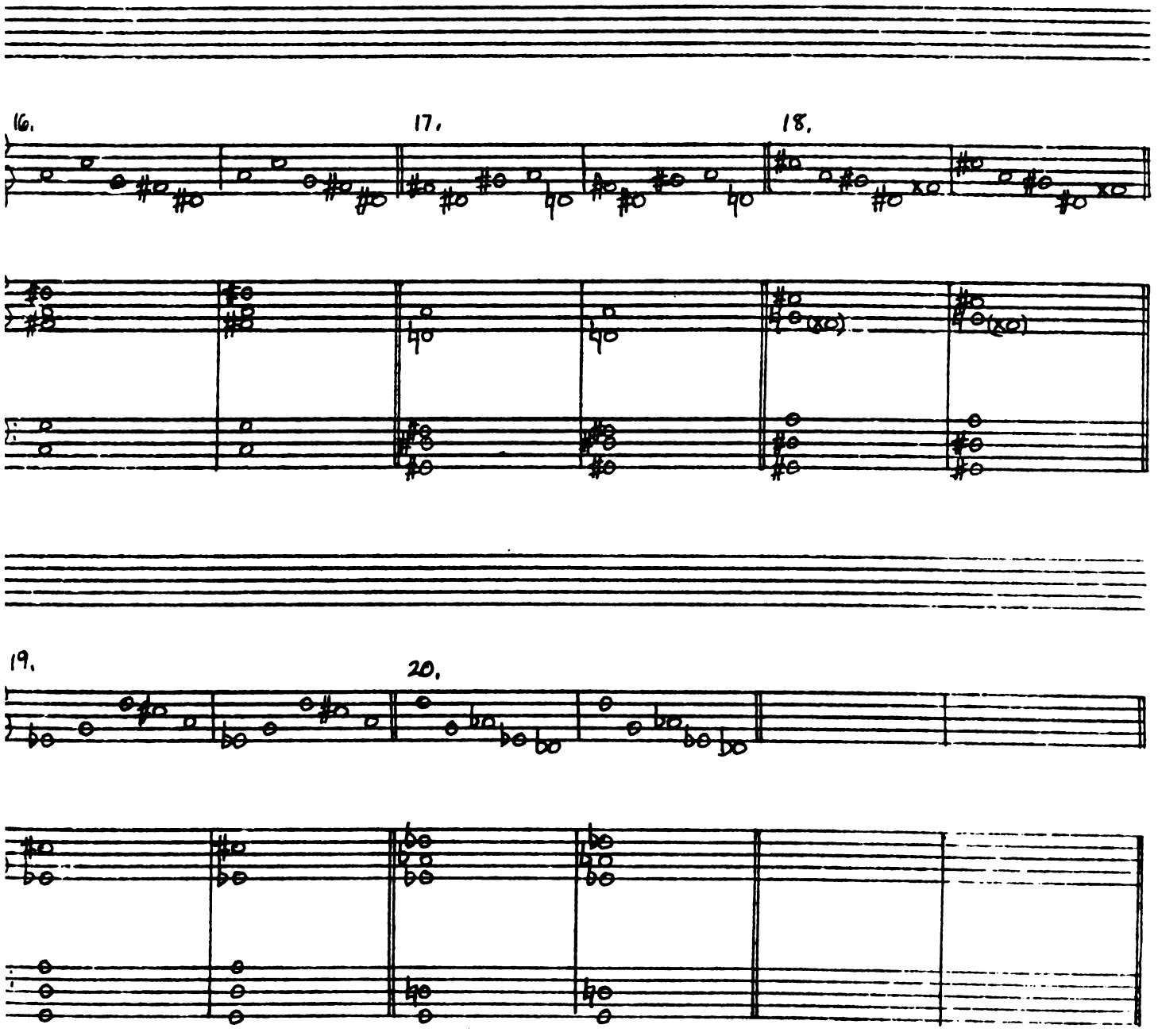
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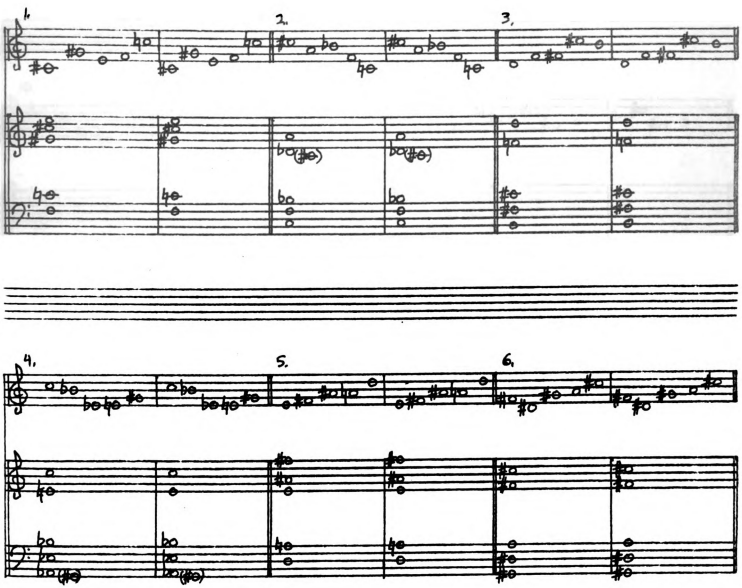
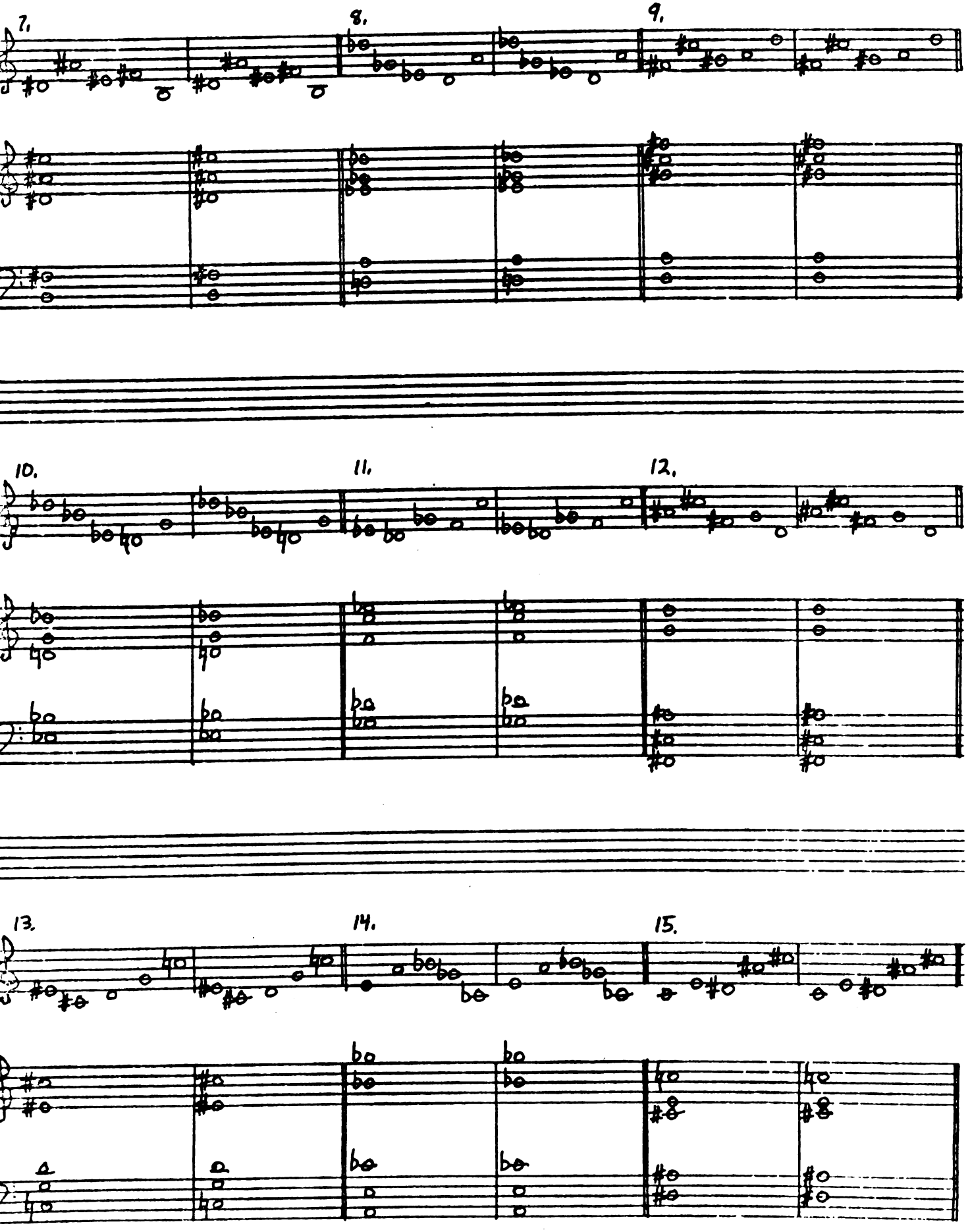
ATONAL SIGHT SINGING DRILLS

UNIT XIX

Name Date

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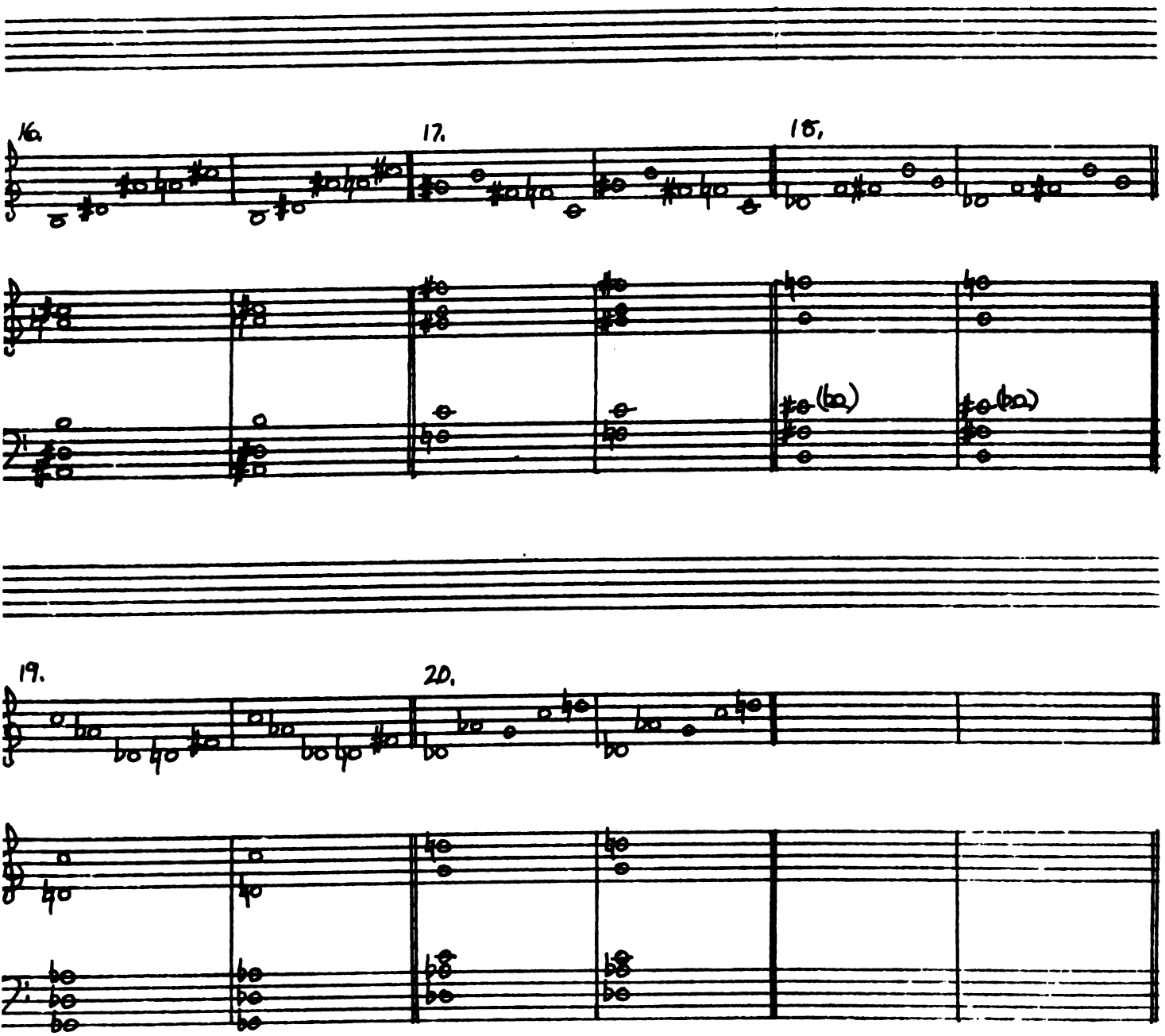
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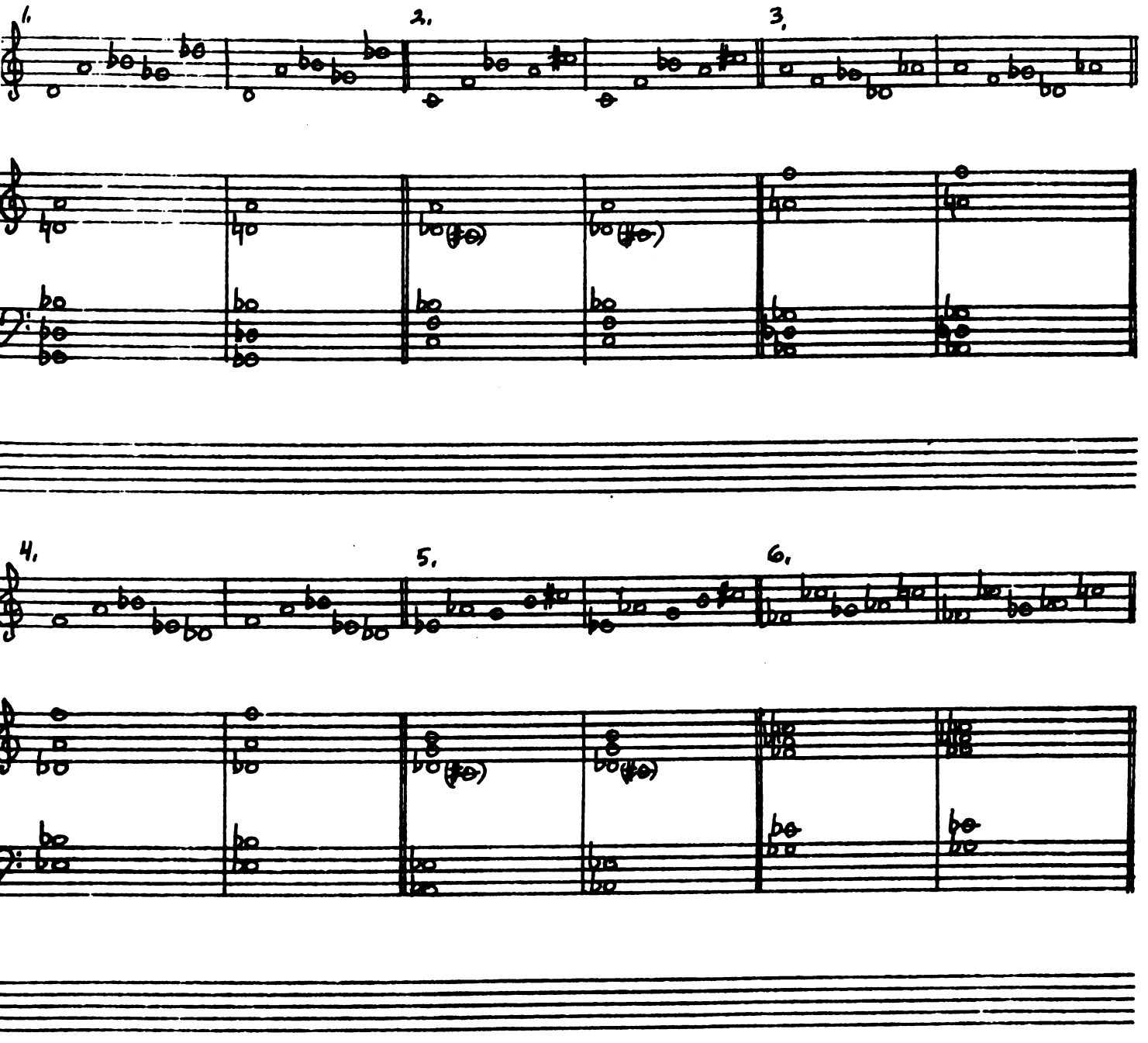
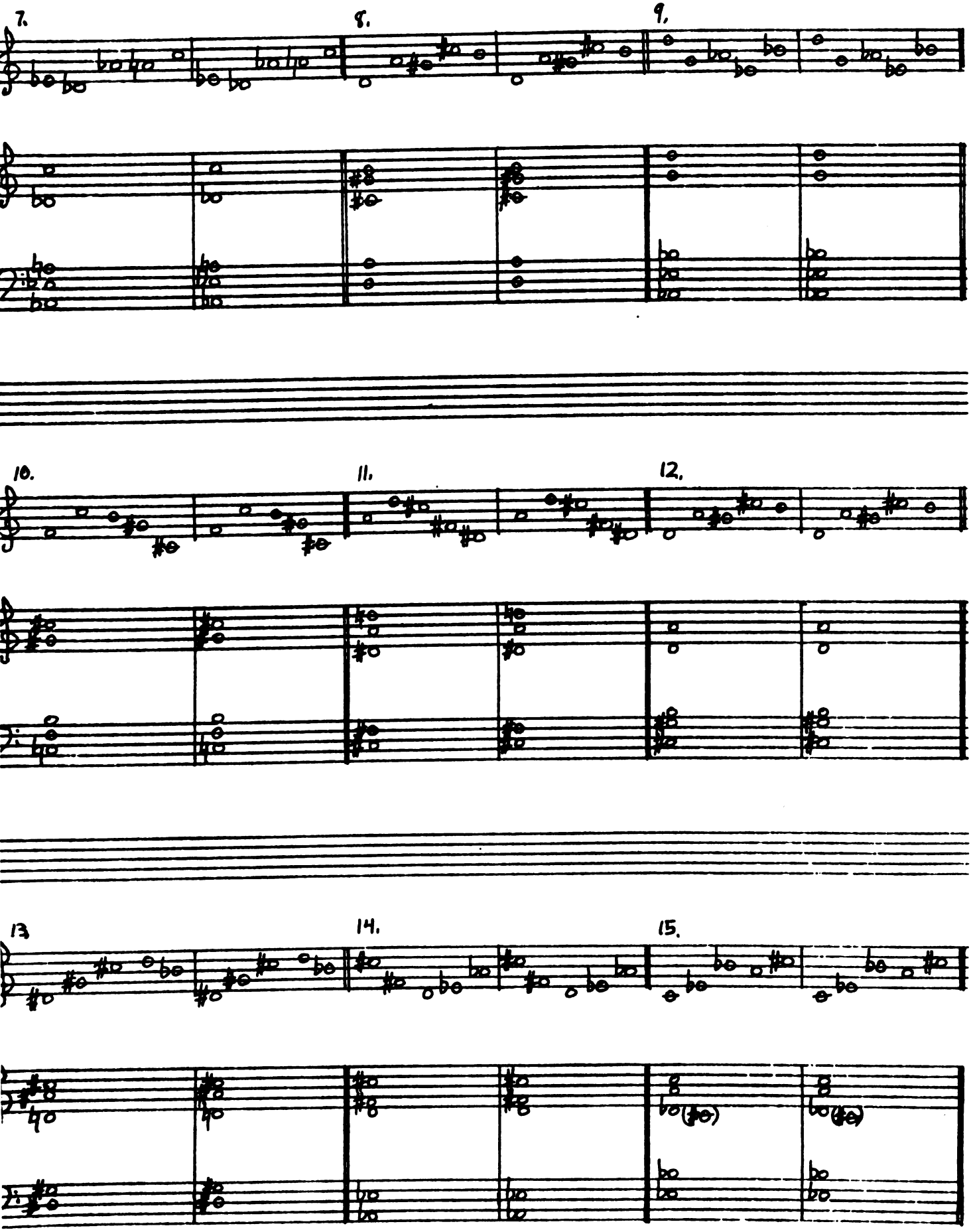
ATONAL SIGHT SINGING DRILLS

UNIT XX

Name Date

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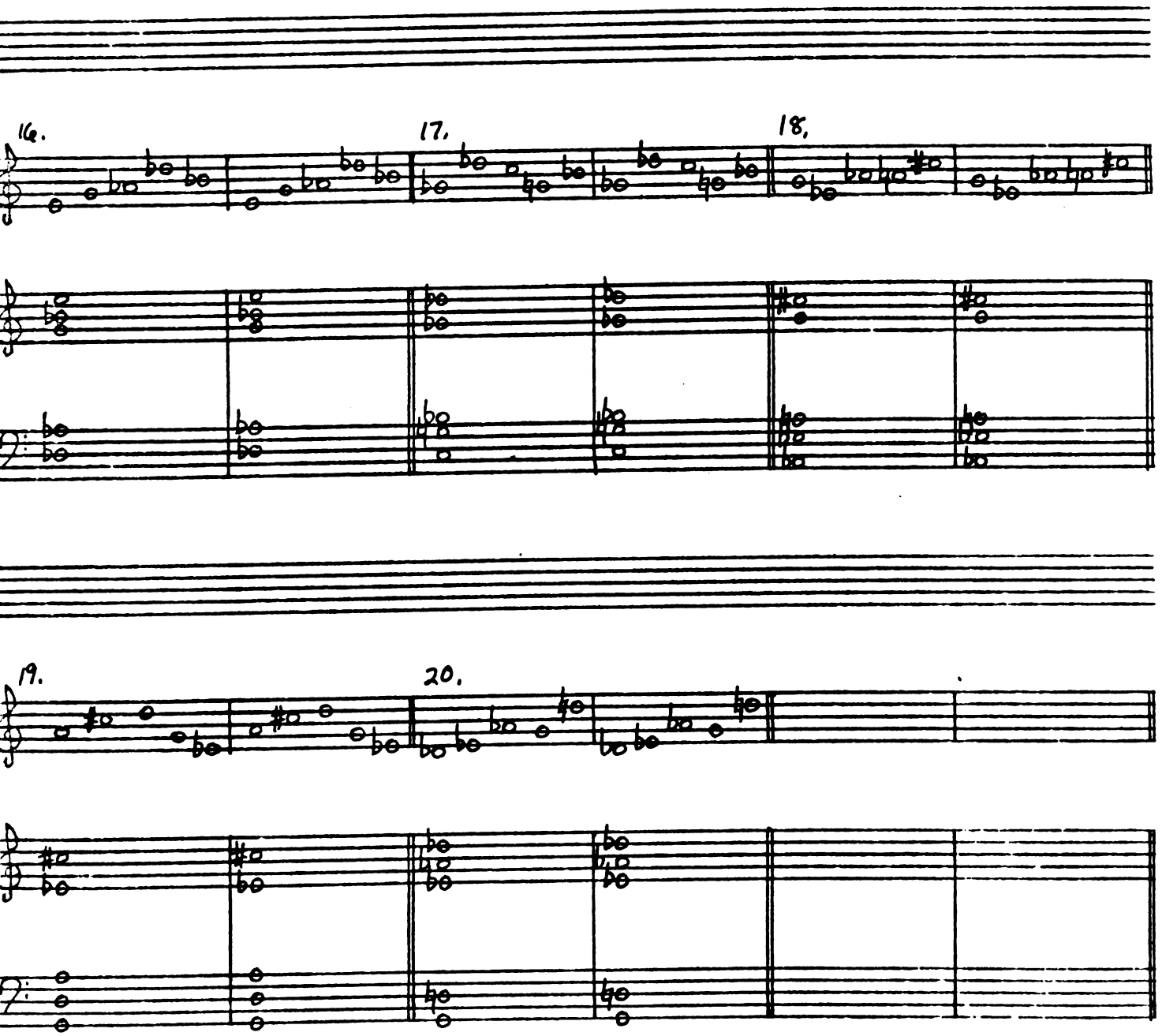
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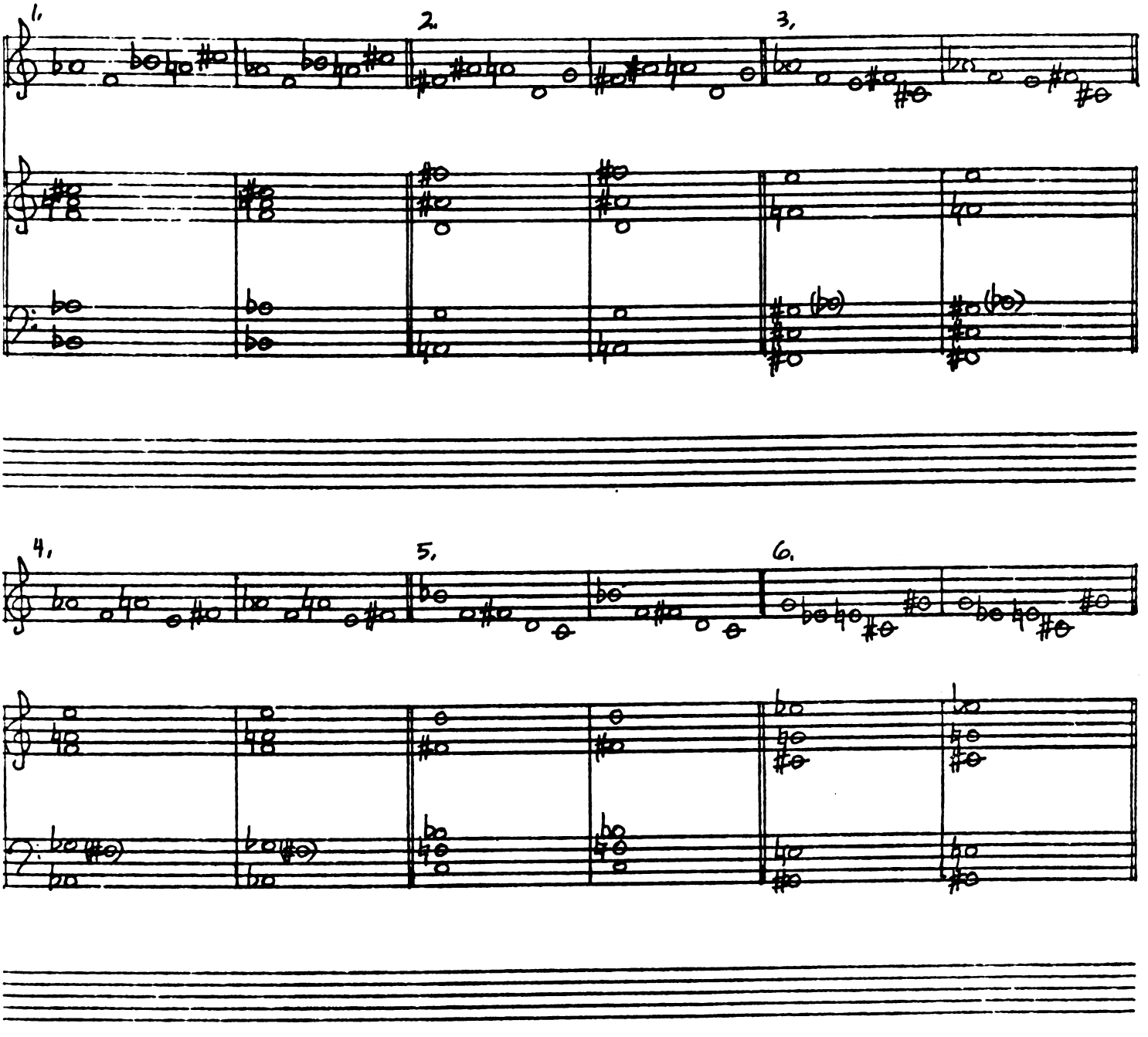
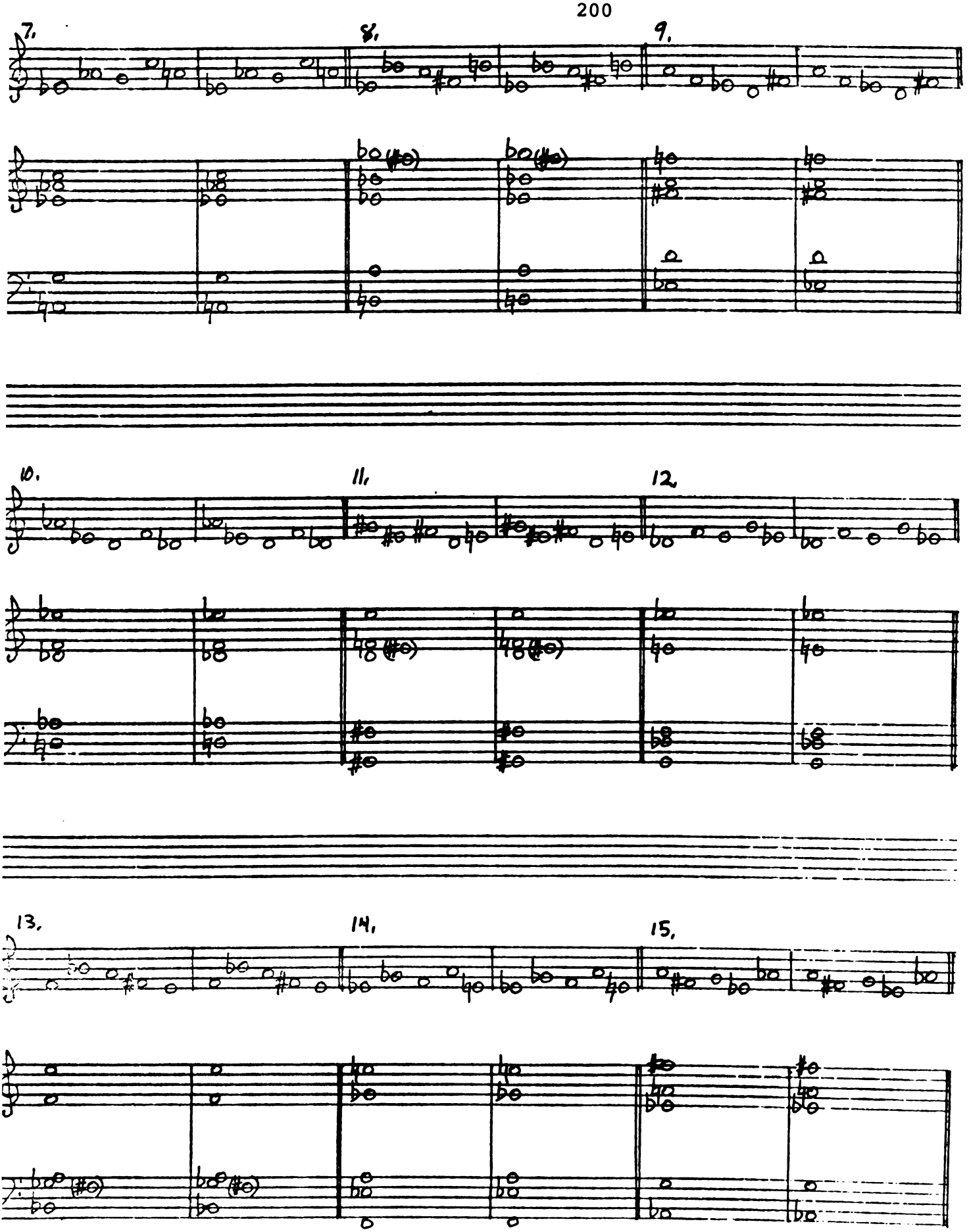
ATONAL SIGHT SINGING DRILLS

UNIT XXI

Name Date

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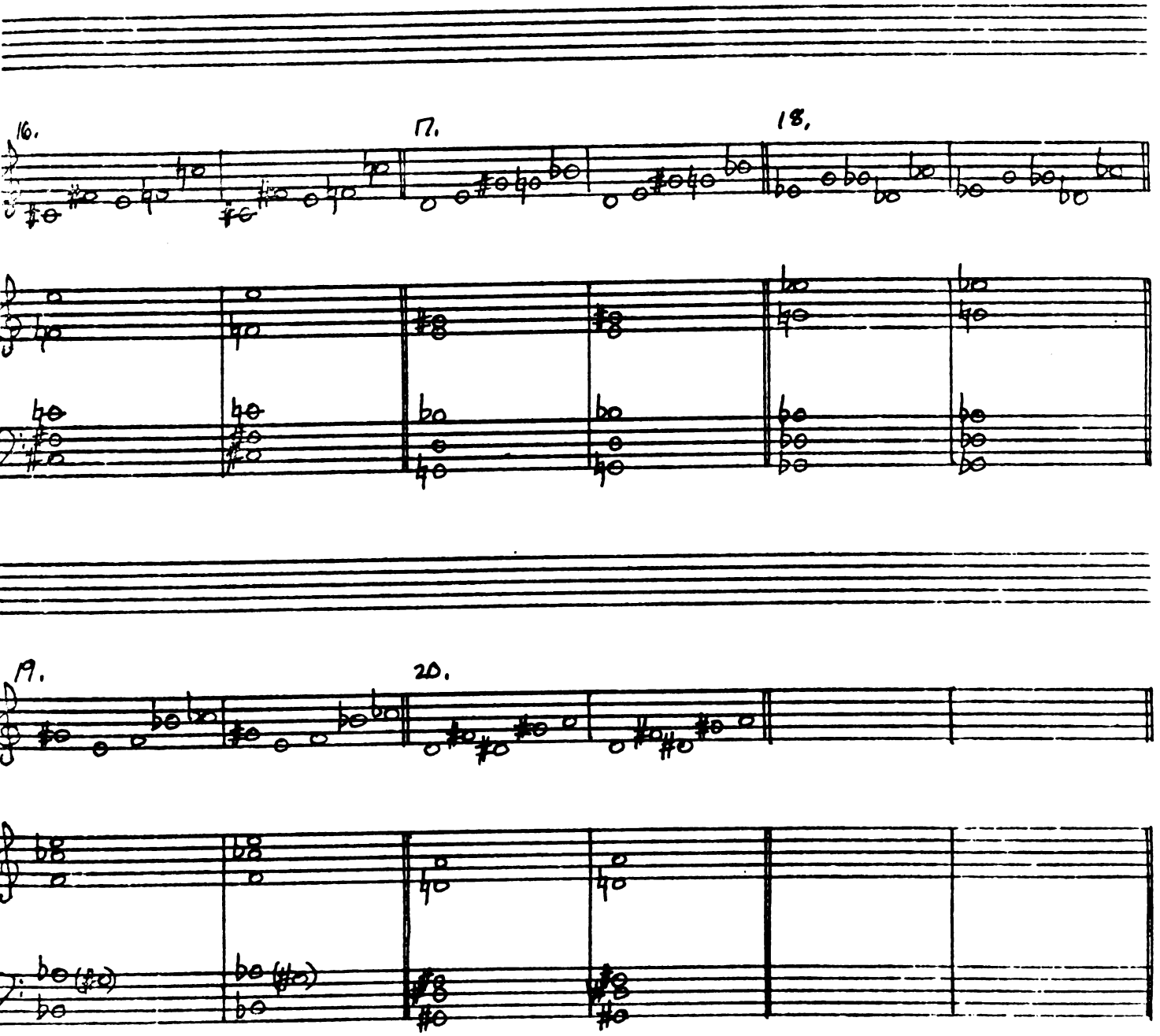
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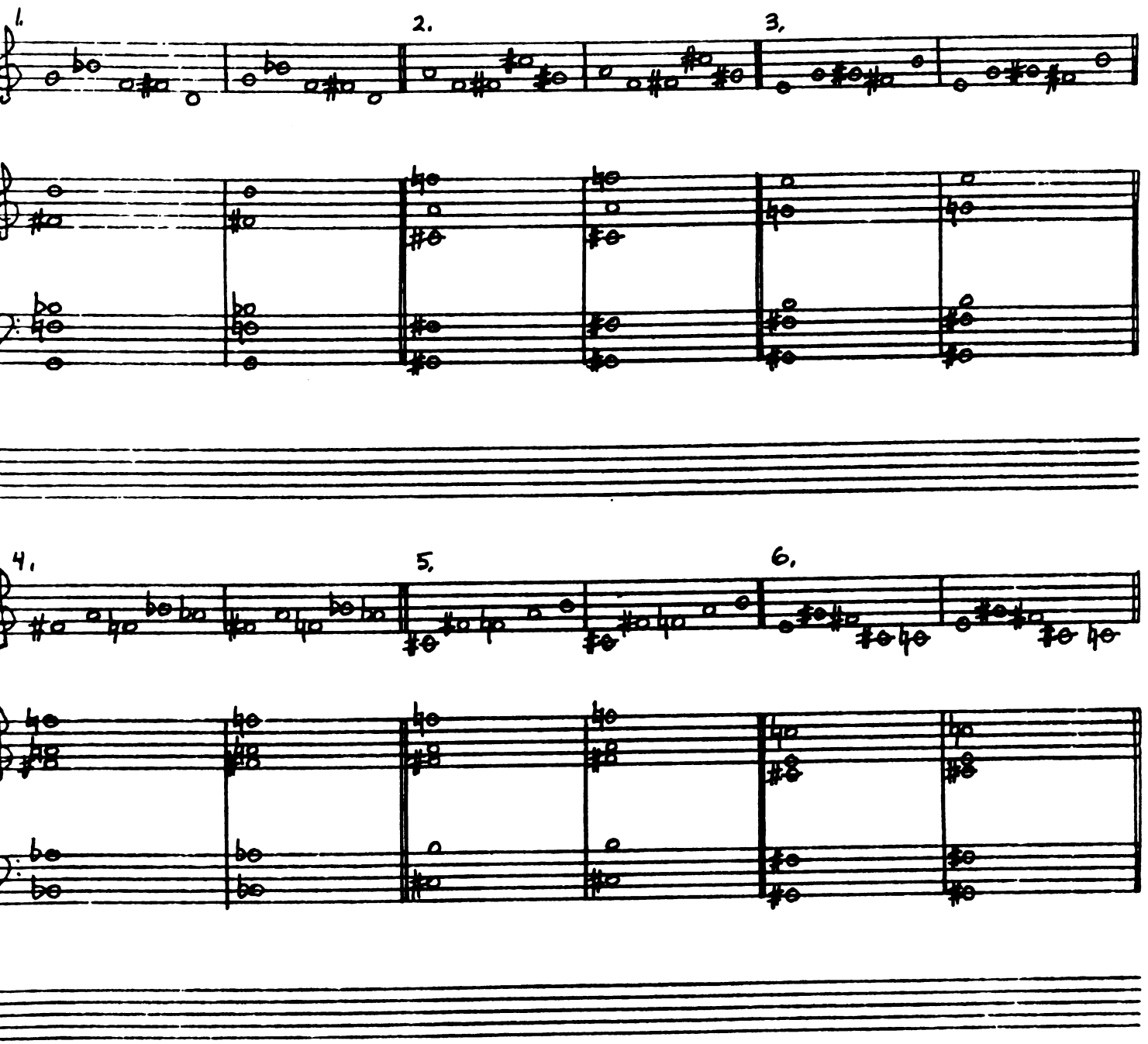
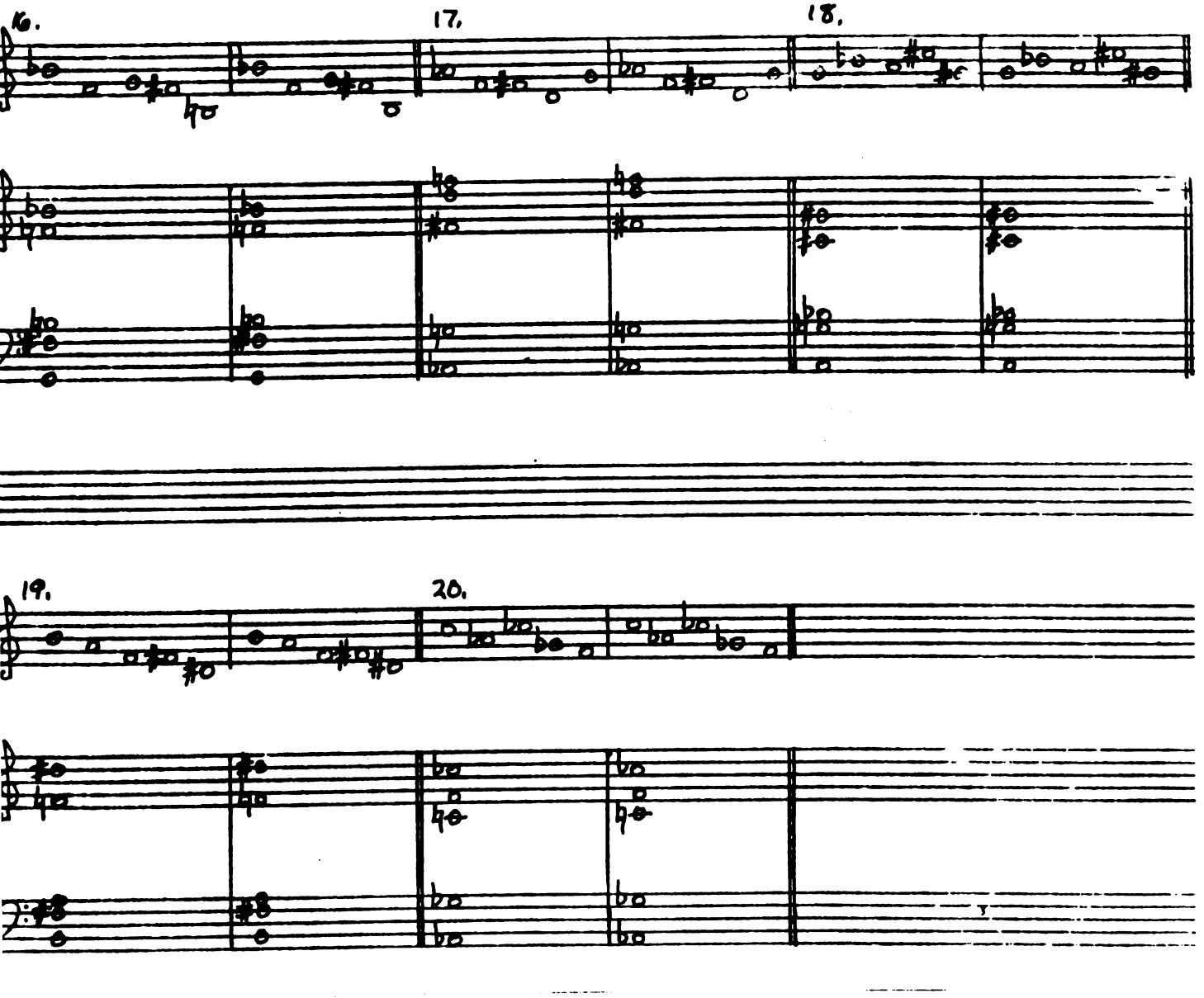
ATONAL SIGHT SINGING DRILLS

UNIT XXII

Name Date

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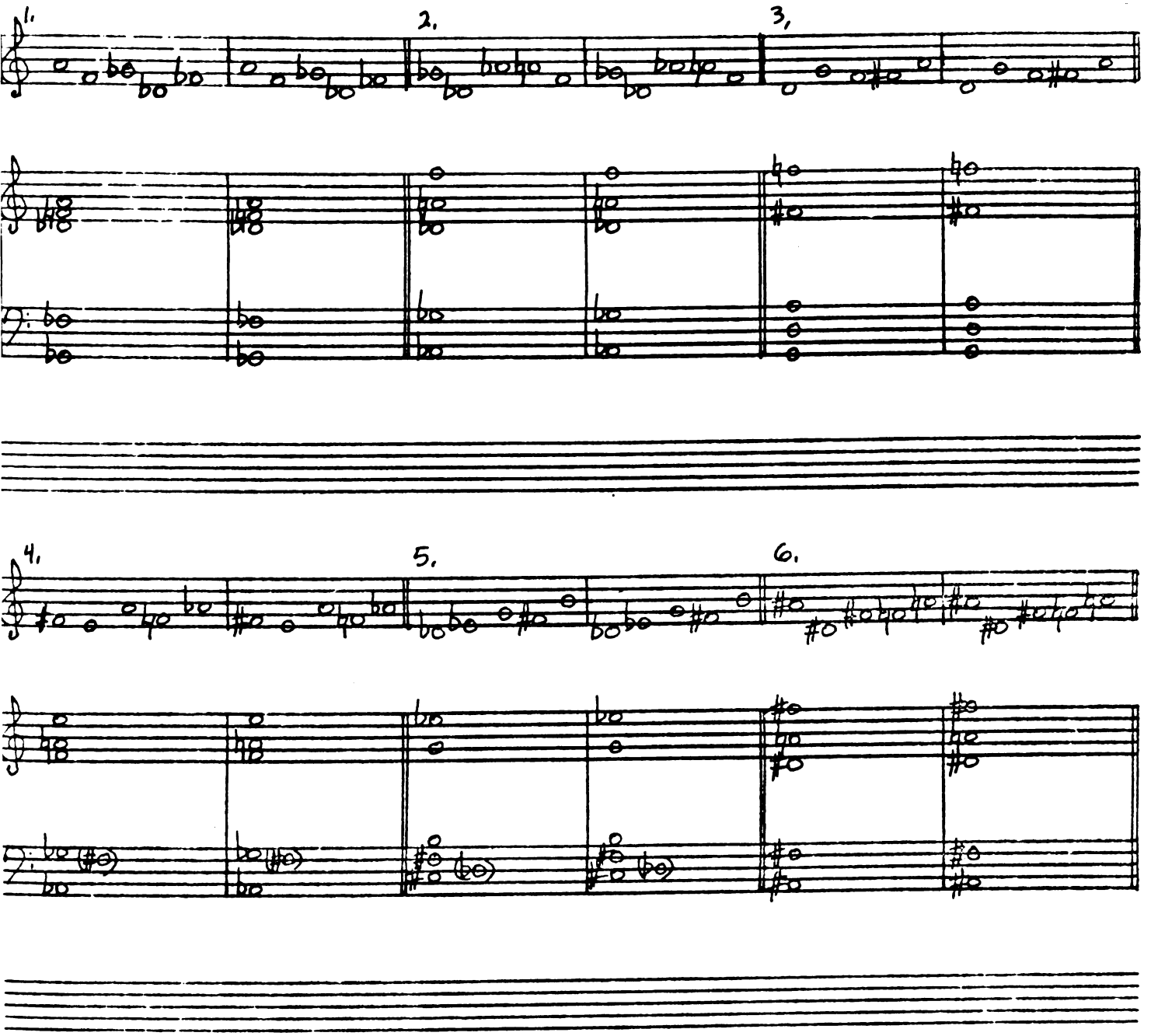
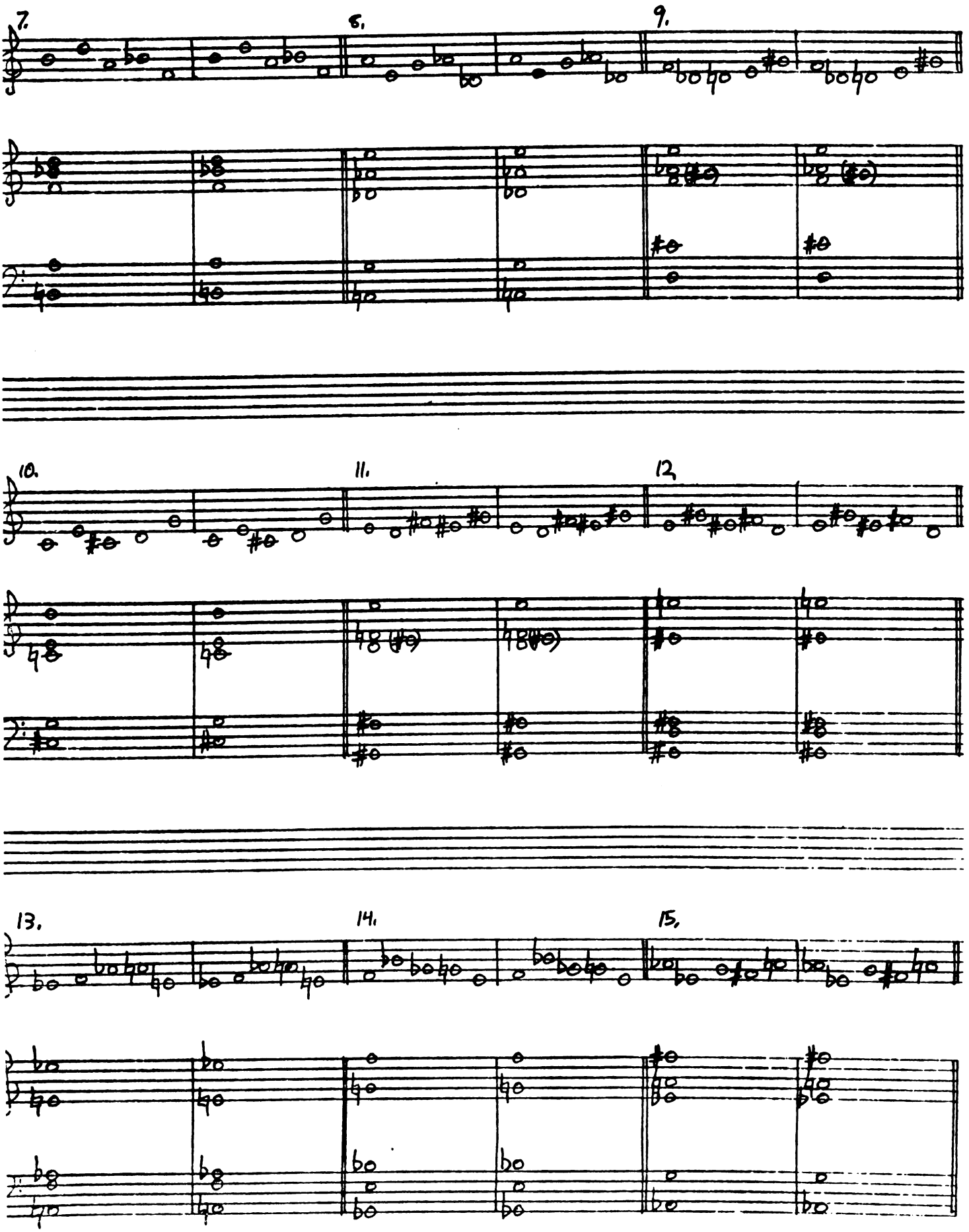
ATONAL SIGHT SINGING DRILLS

UNIT XXIII

Name Date

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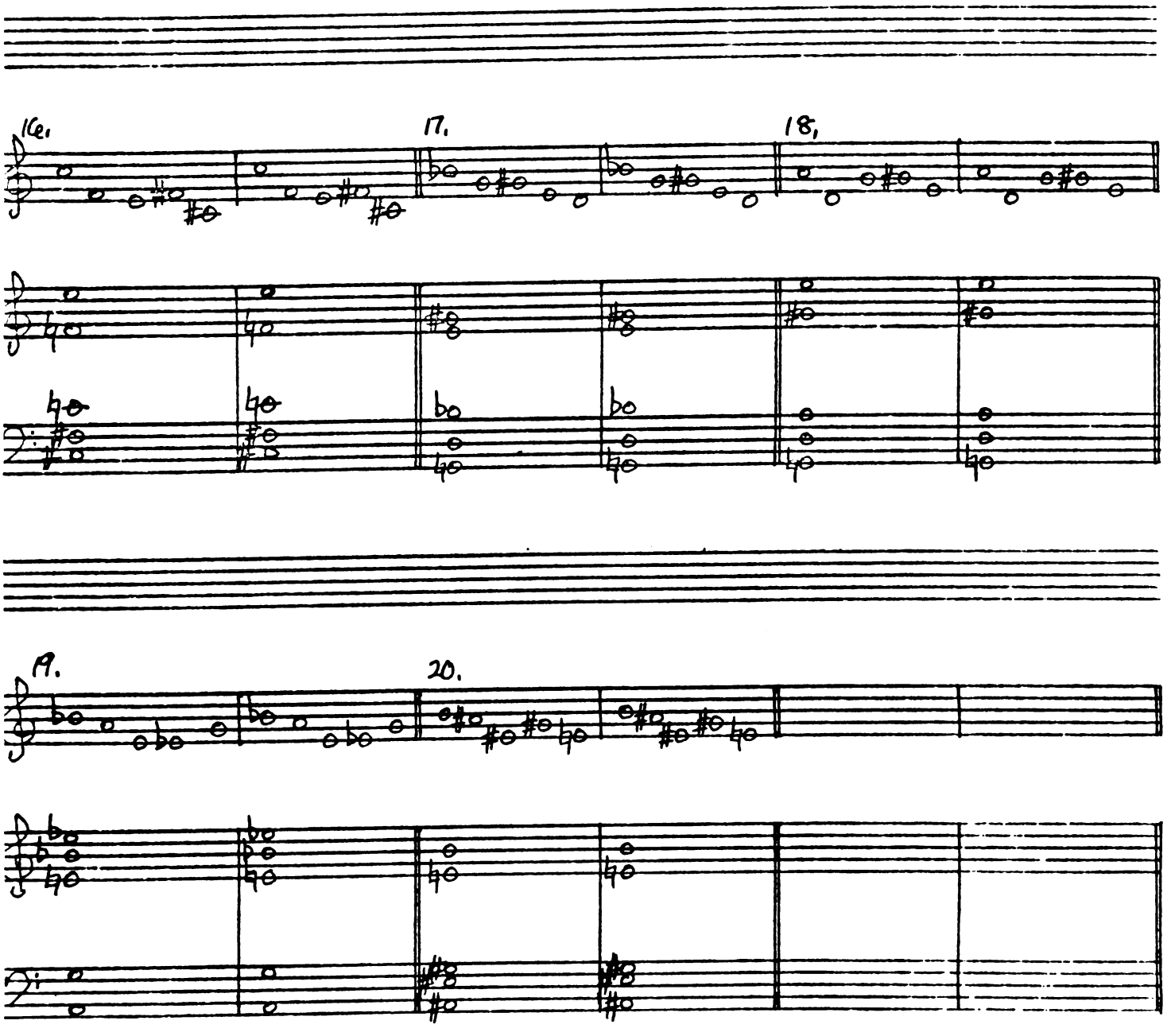
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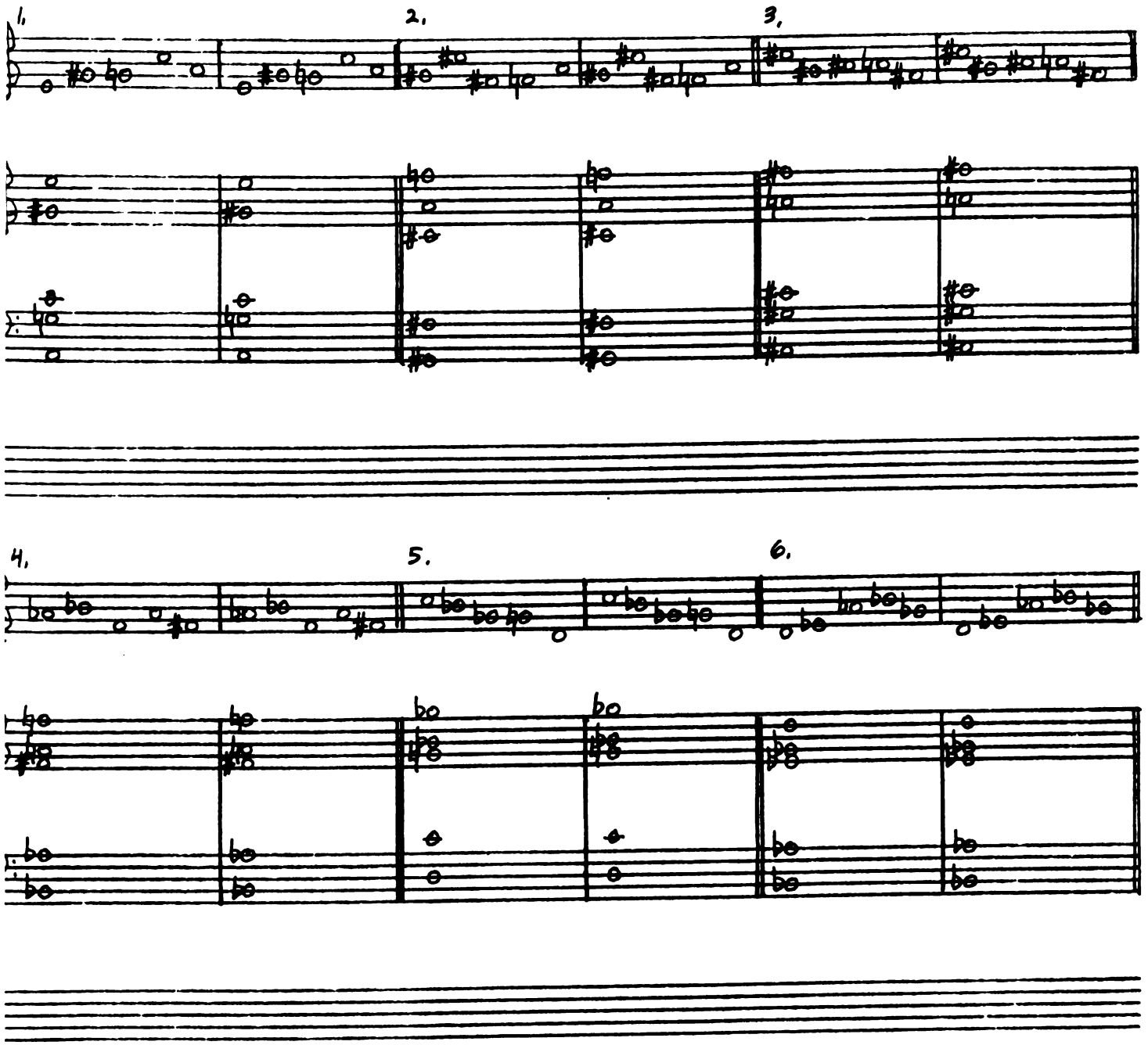
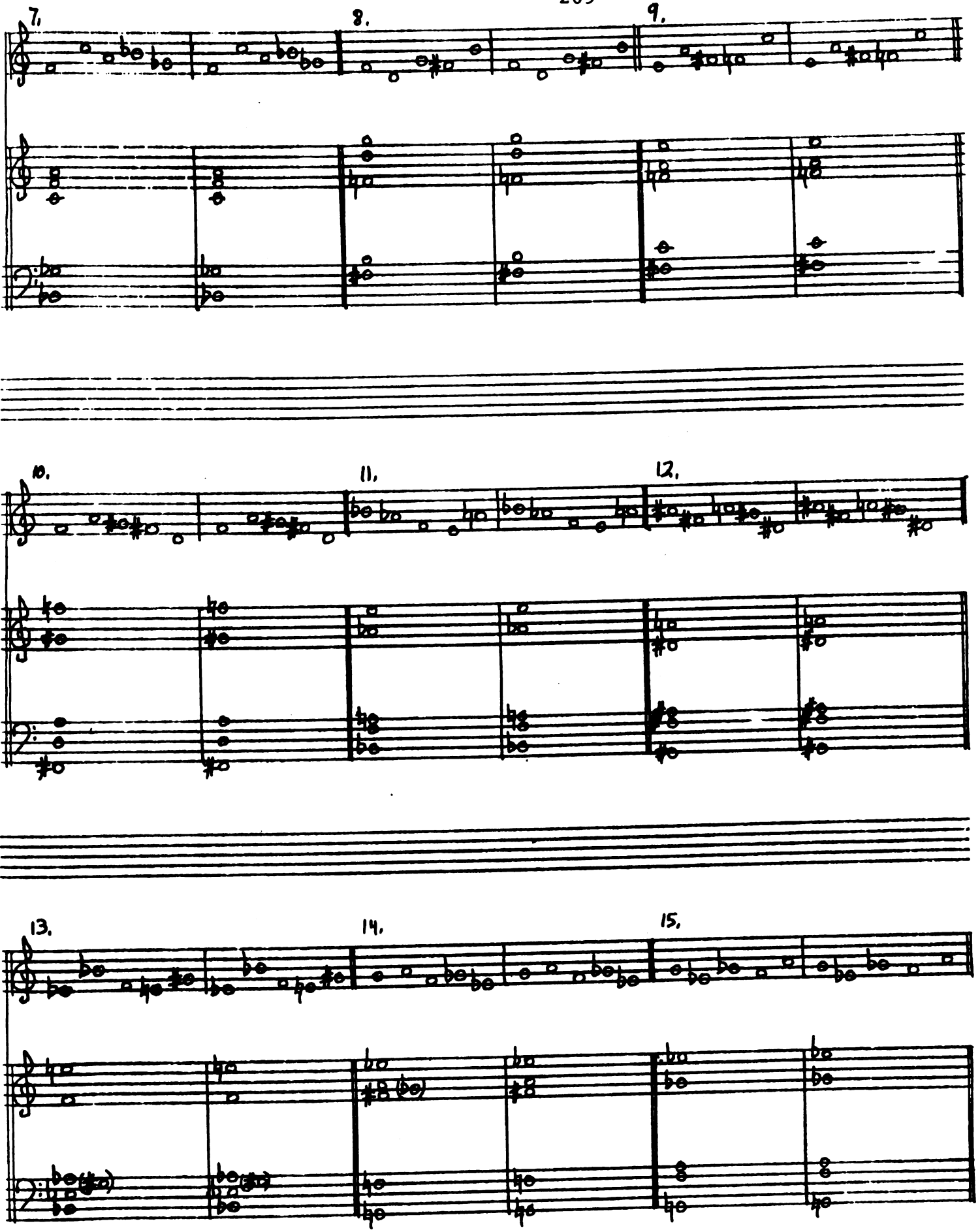
ATONAL SIGHT SINGING DRILLS

UNIT XXIV

Name Date

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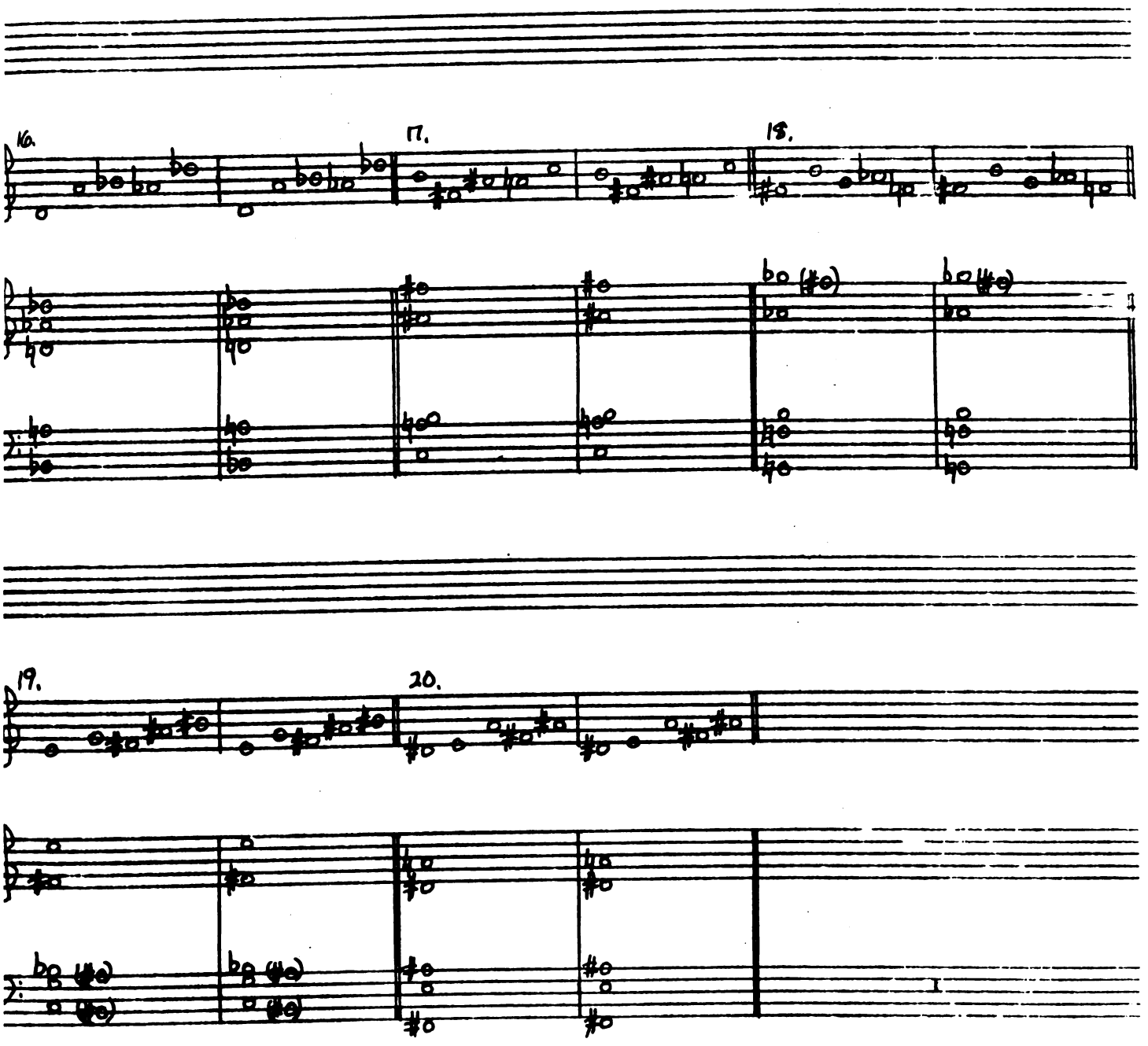
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APPENDIX C

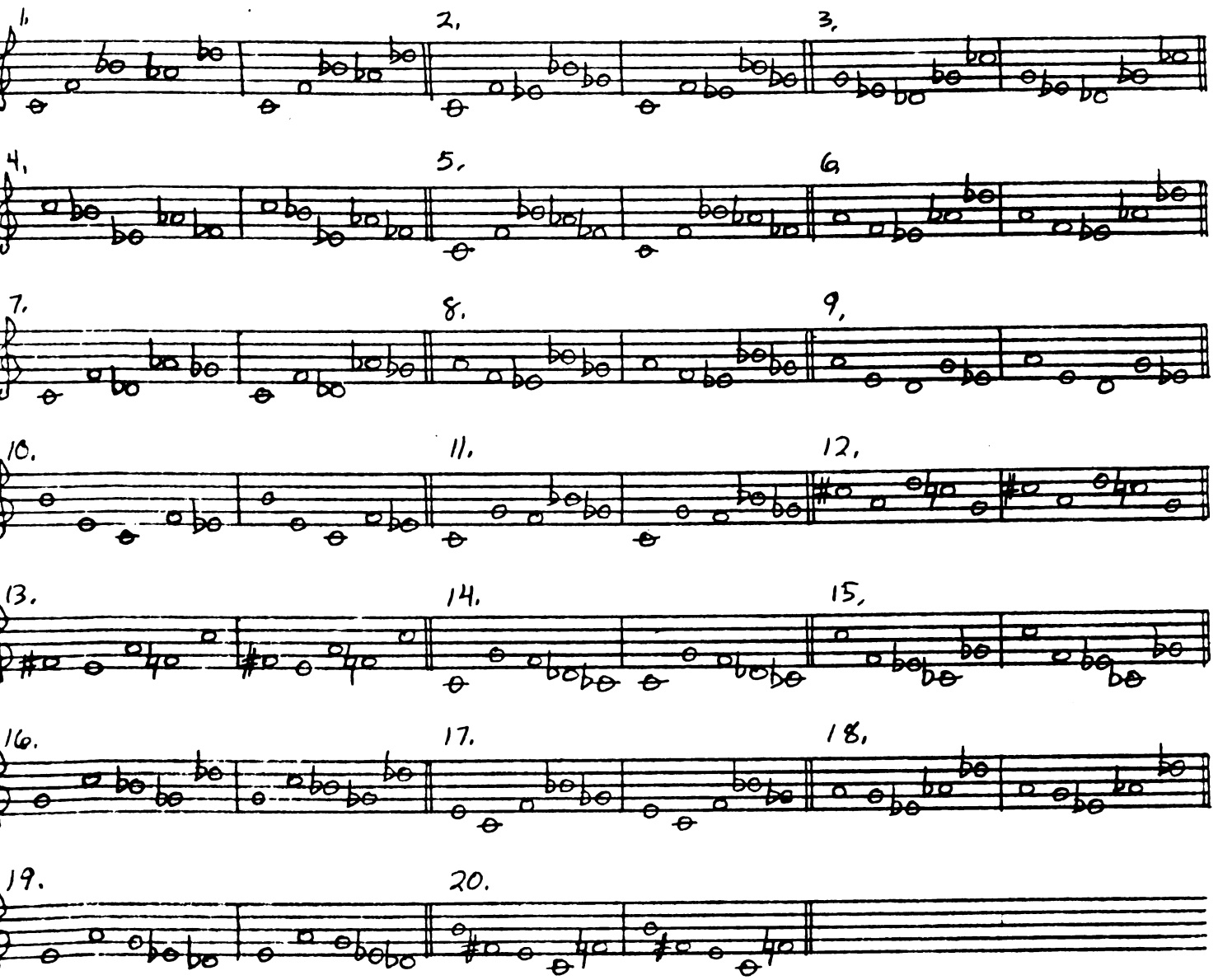
ATONAL SIGHT SINGING DRILLS FOR CONTROL GROUP SUBJECTS

APPENDIX C

ATONAL SIGHT SINGING DRILLS

UNIT I

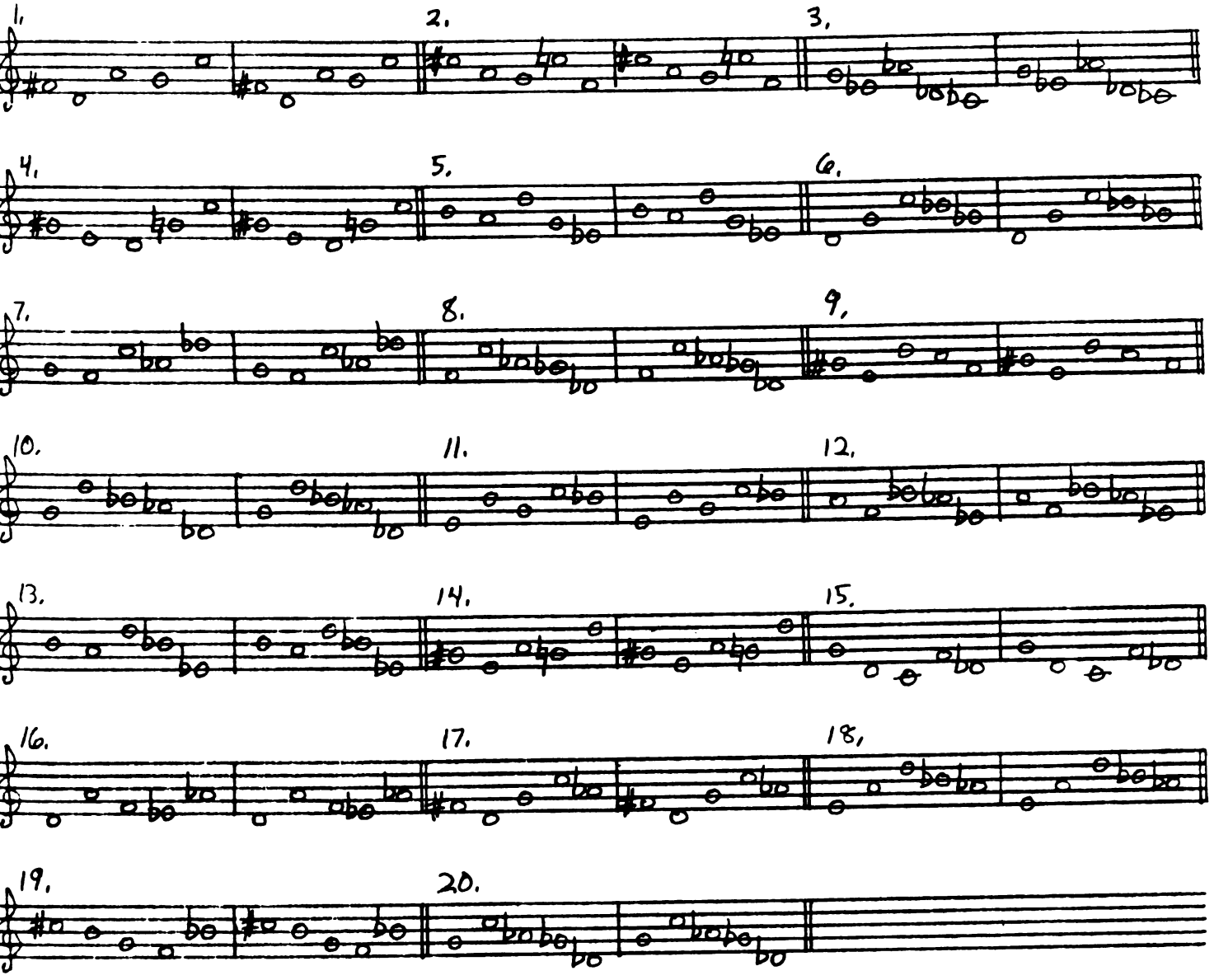
Name Date



ATONAL SIGHT SINGING DRILLS

UNIT II

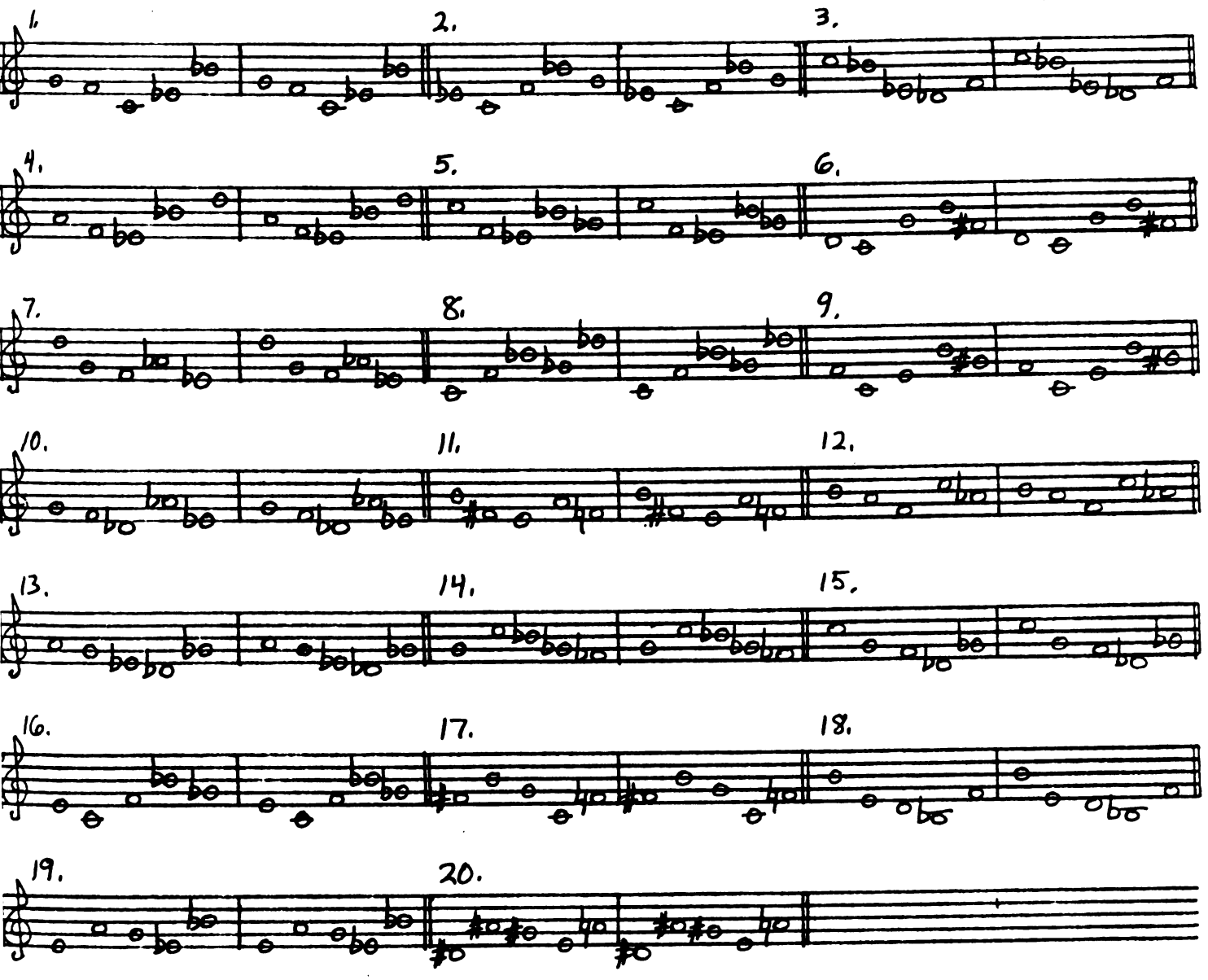
Name Date



ATONAL SIGHT SINGING DRILLS

UNIT III

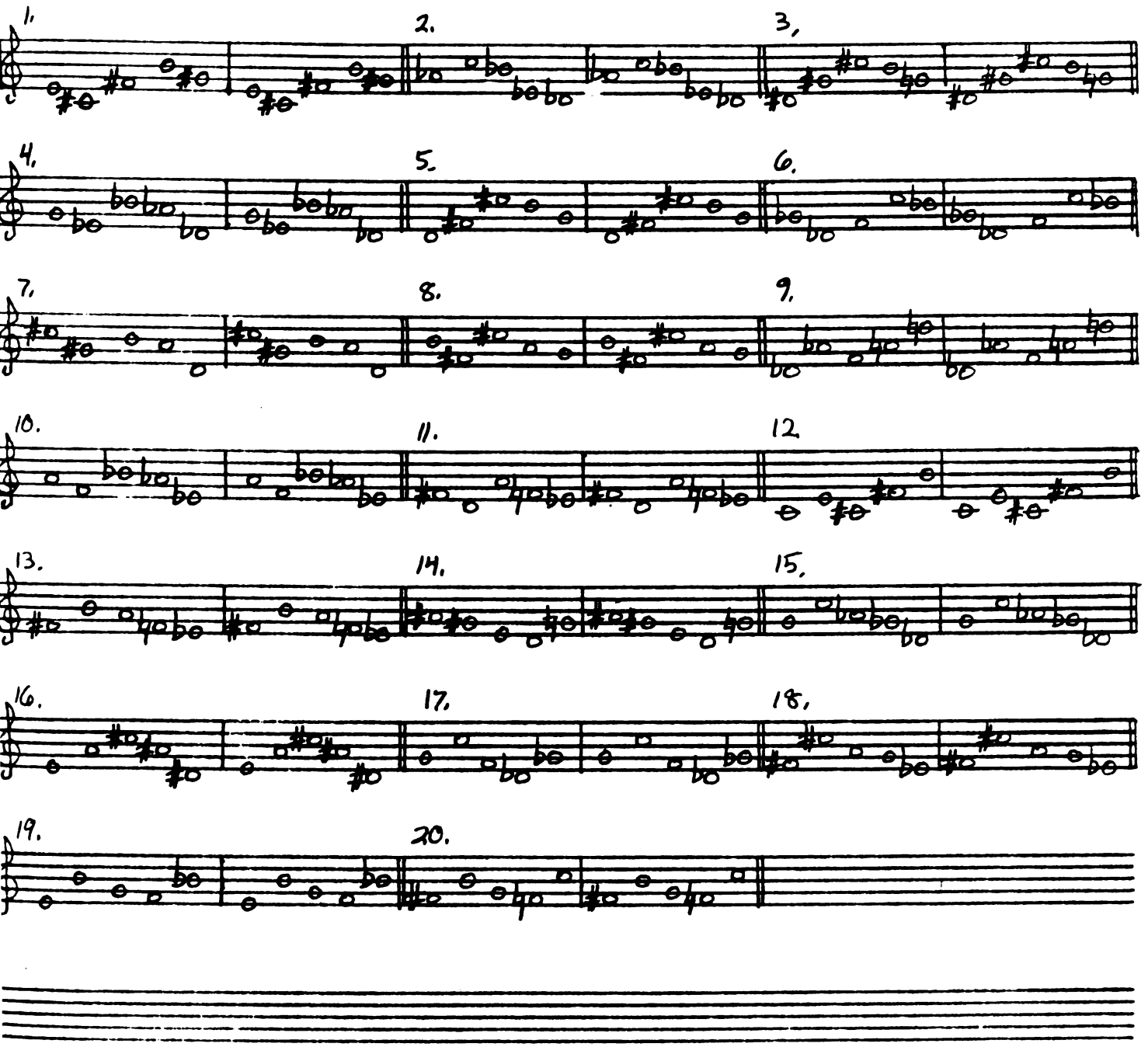
Name **Date**



ATONAL SIGHT SINGING DRILLS

UNIT IV

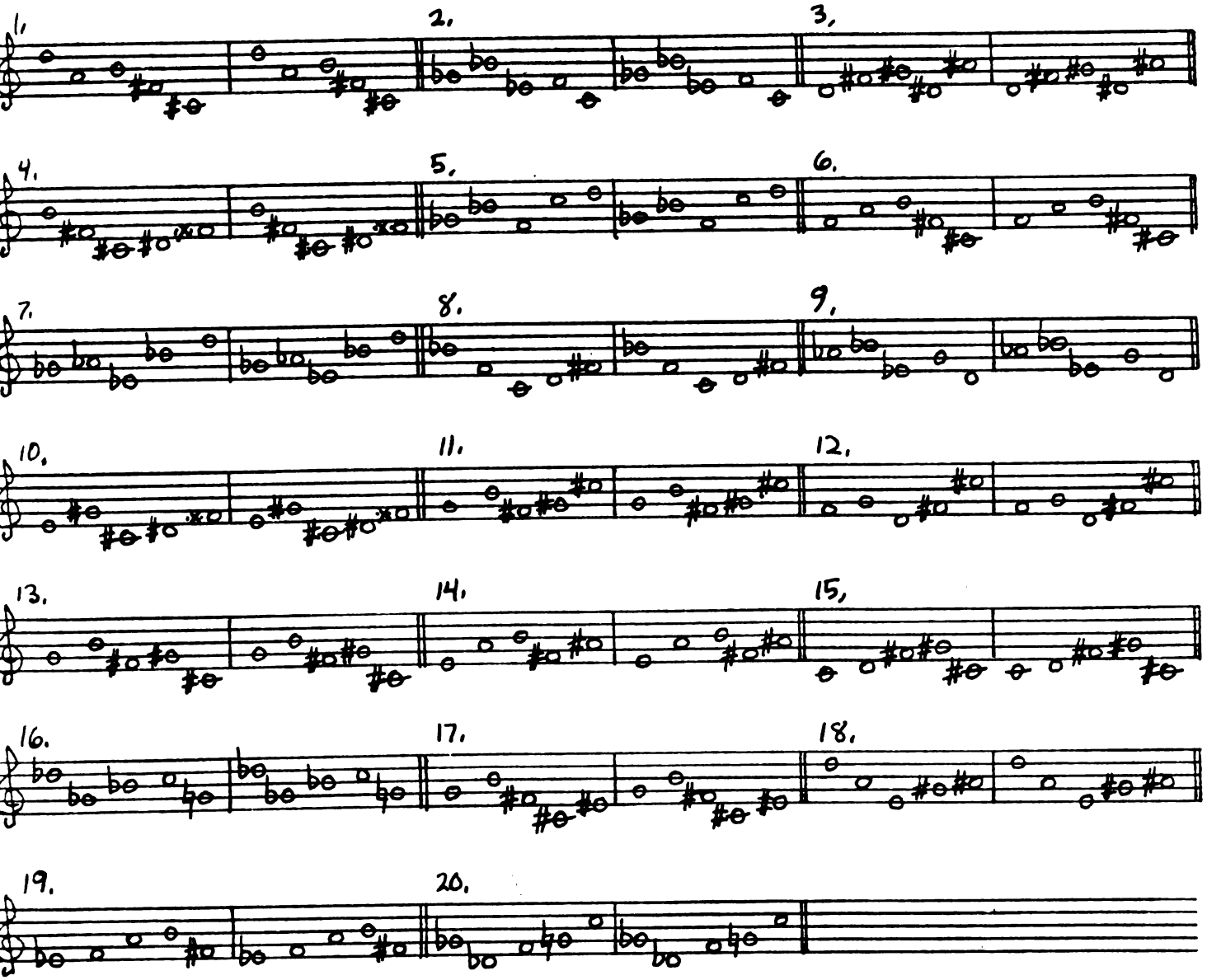
Name Date



ATONAL SIGHT SINGING DRILLS

UNIT V

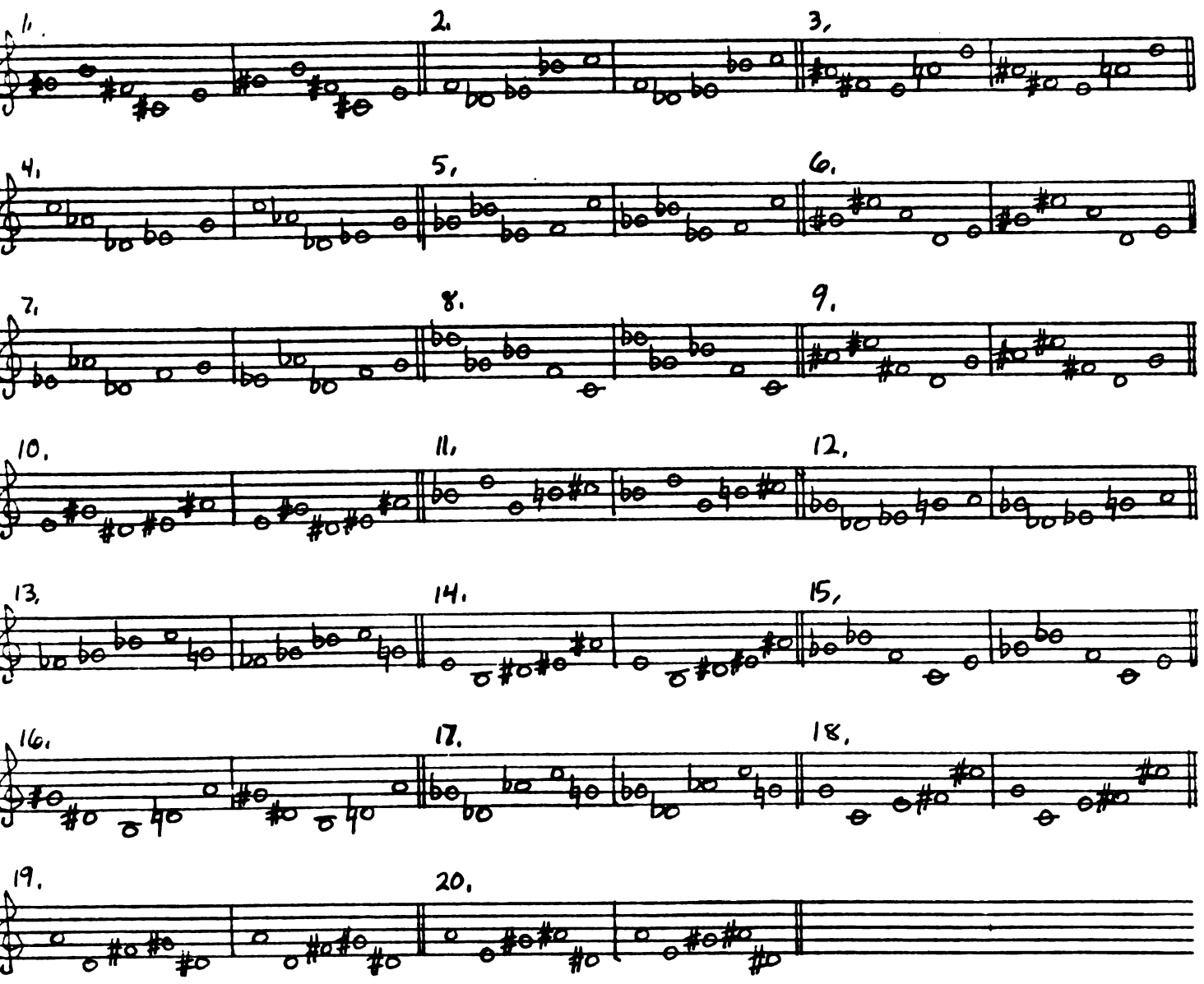
Name Date



ATONAL SIGHT SINGING DRILLS

UNIT VI

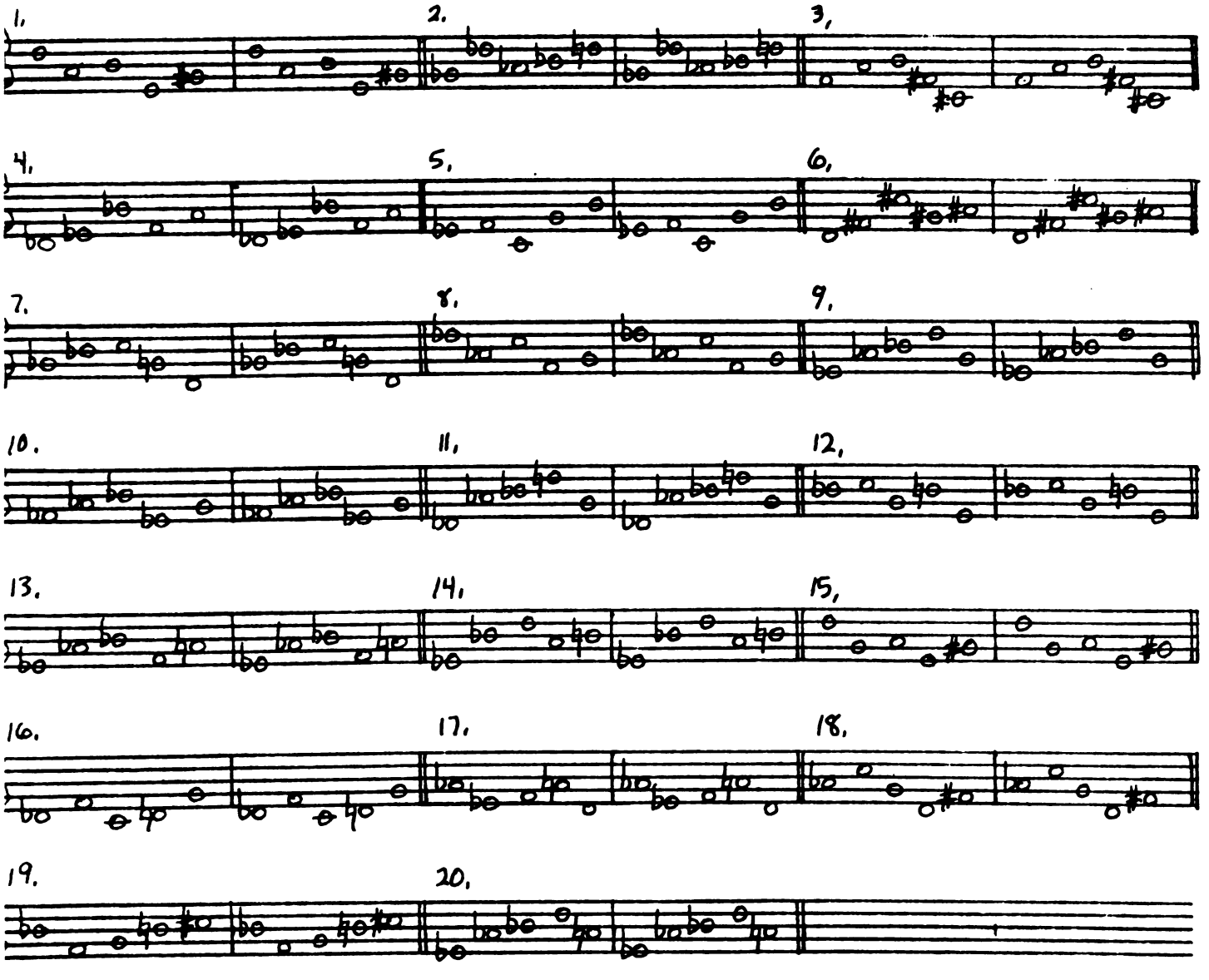
Name Date



ATONAL SIGHT SINGING DRILLS

UNIT VII

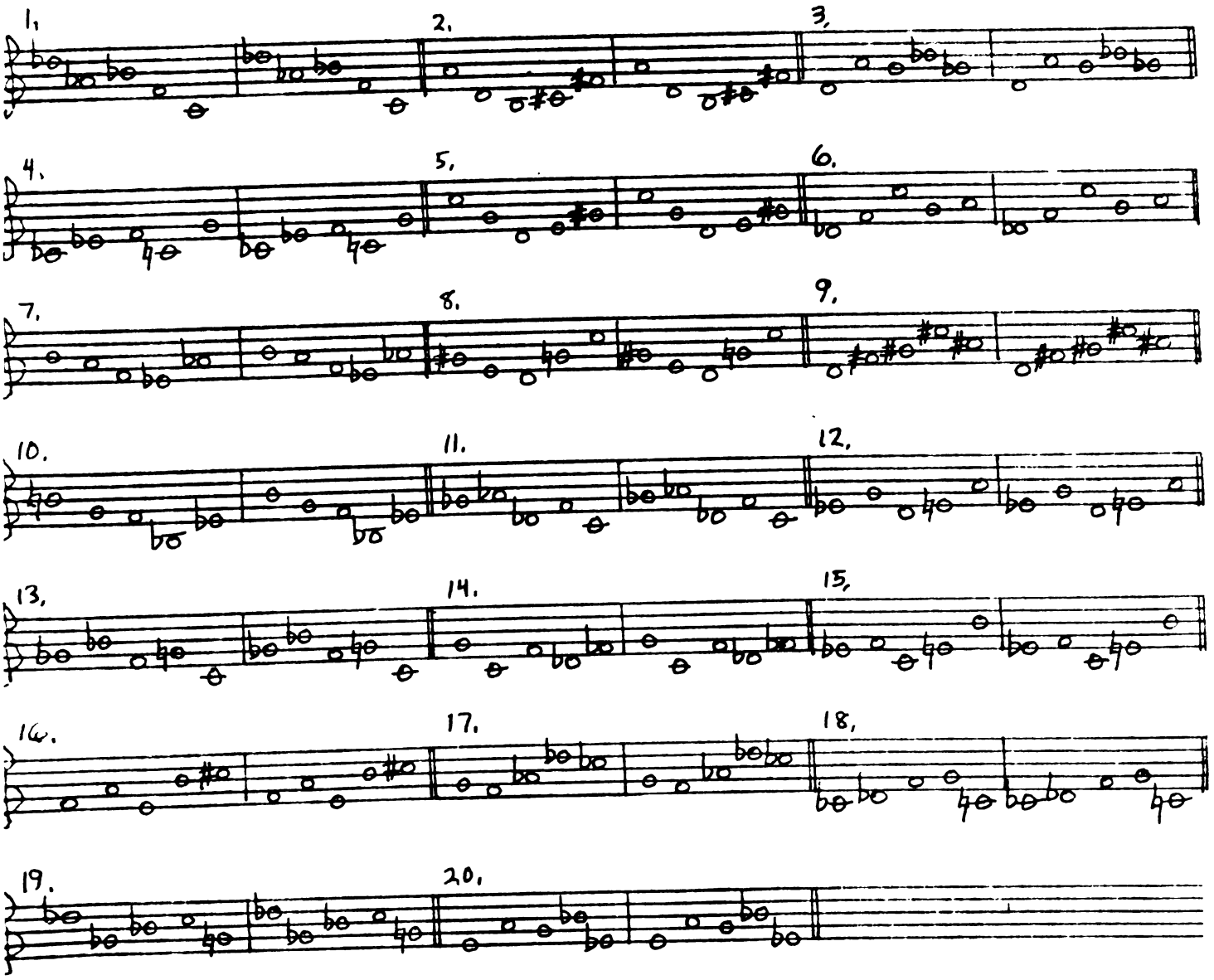
Name Date



ATONAL SIGHT SINGING DRILLS

UNIT VIII

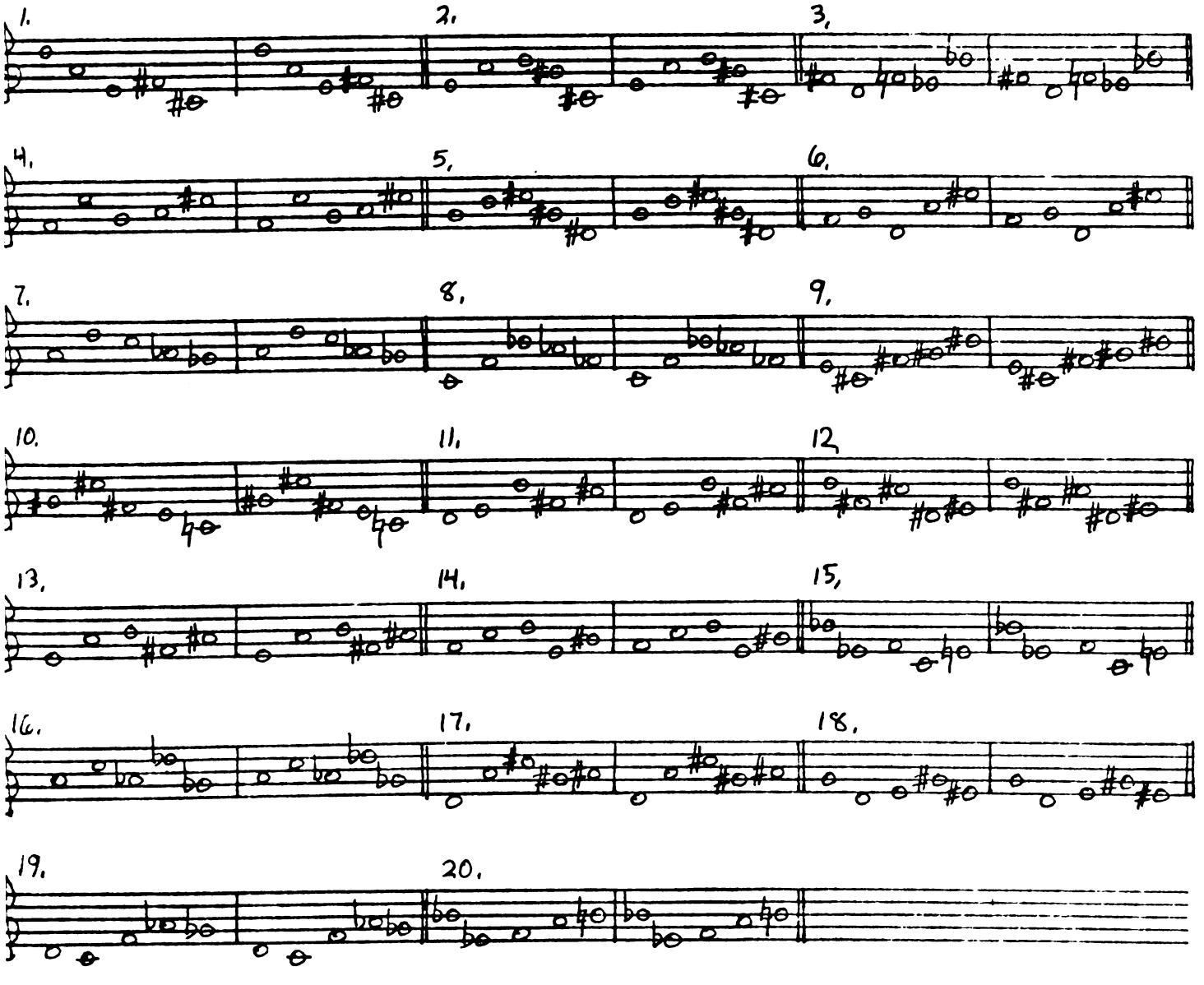
Name Date



ATONAL SIGHT SINGING DRILLS

UNIT IX

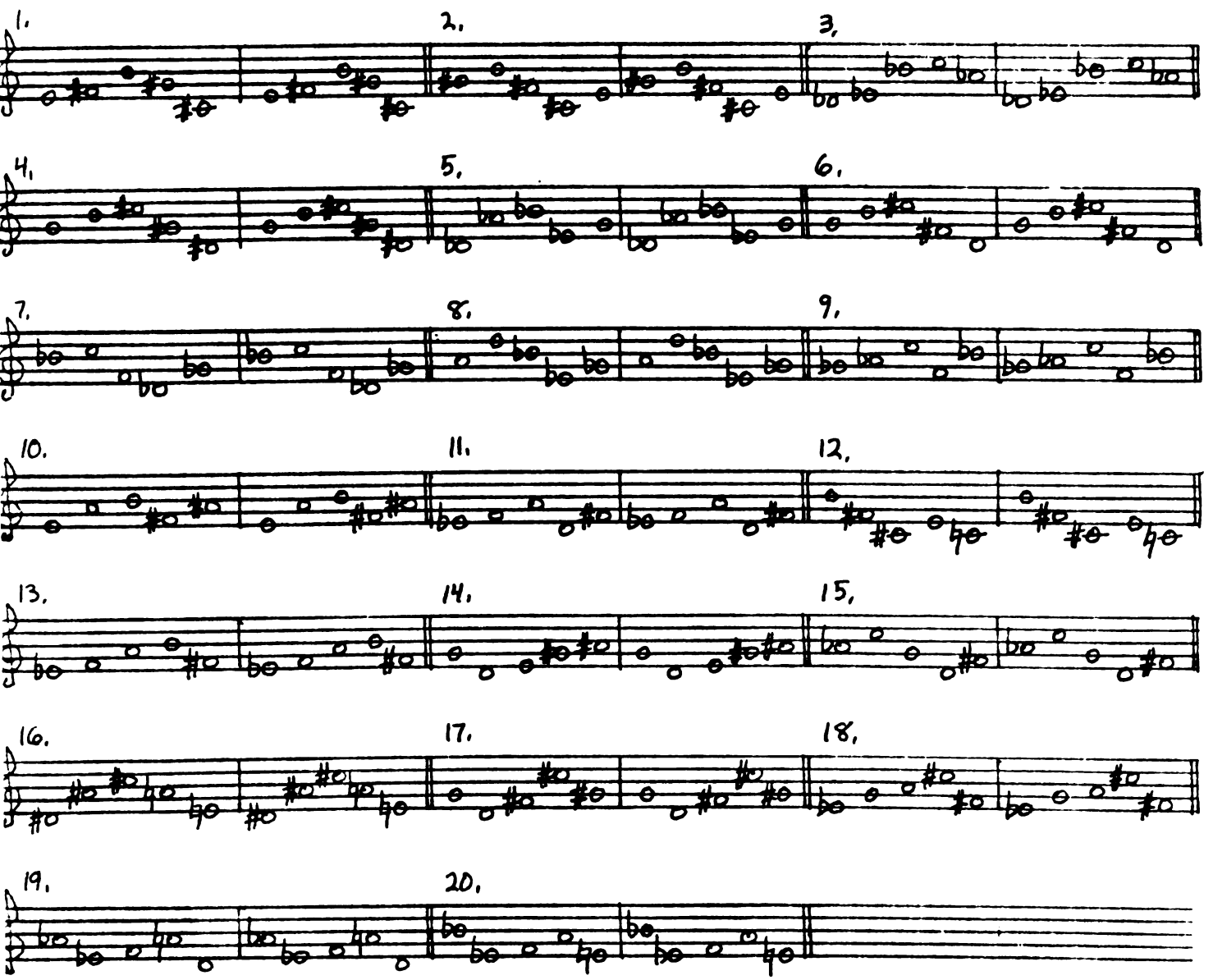
Name Date



ATONAL SIGHT SINGING DRILLS

UNIT X

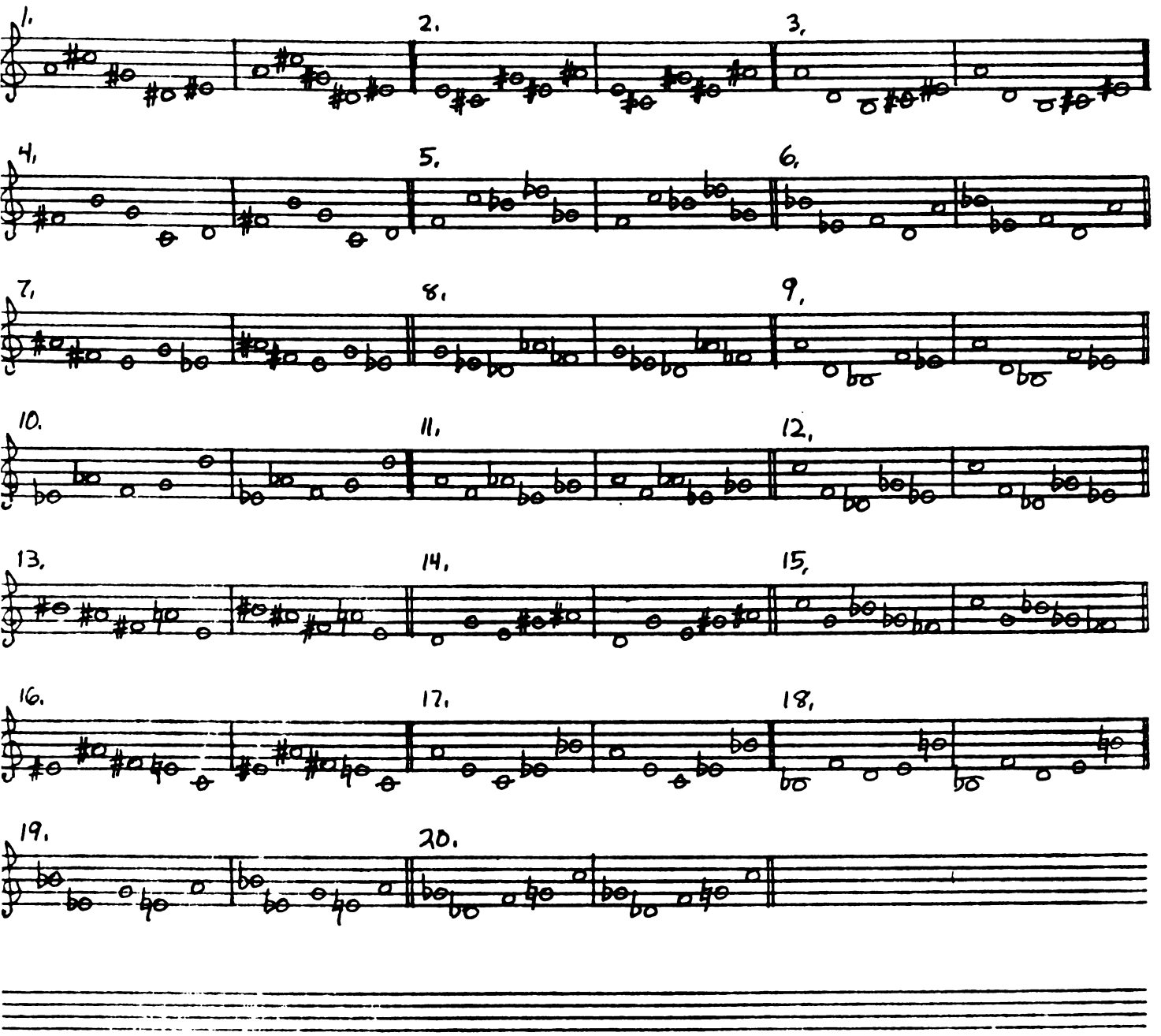
Name Date



ATONAL SIGHT SINGING DRILLS

UNIT XI

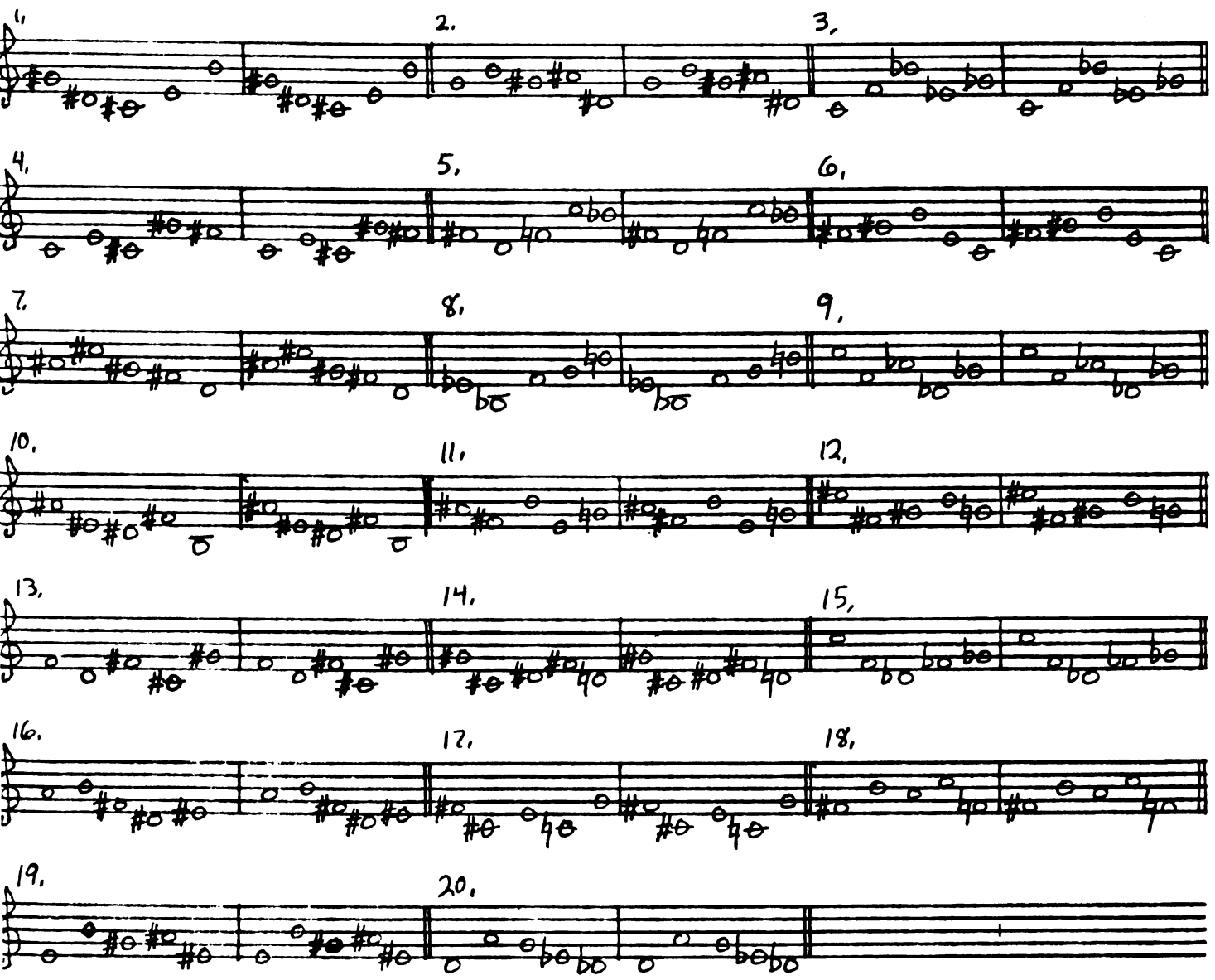
Name Date



ATONAL SIGHT SINGING DRILLS

UNIT XII

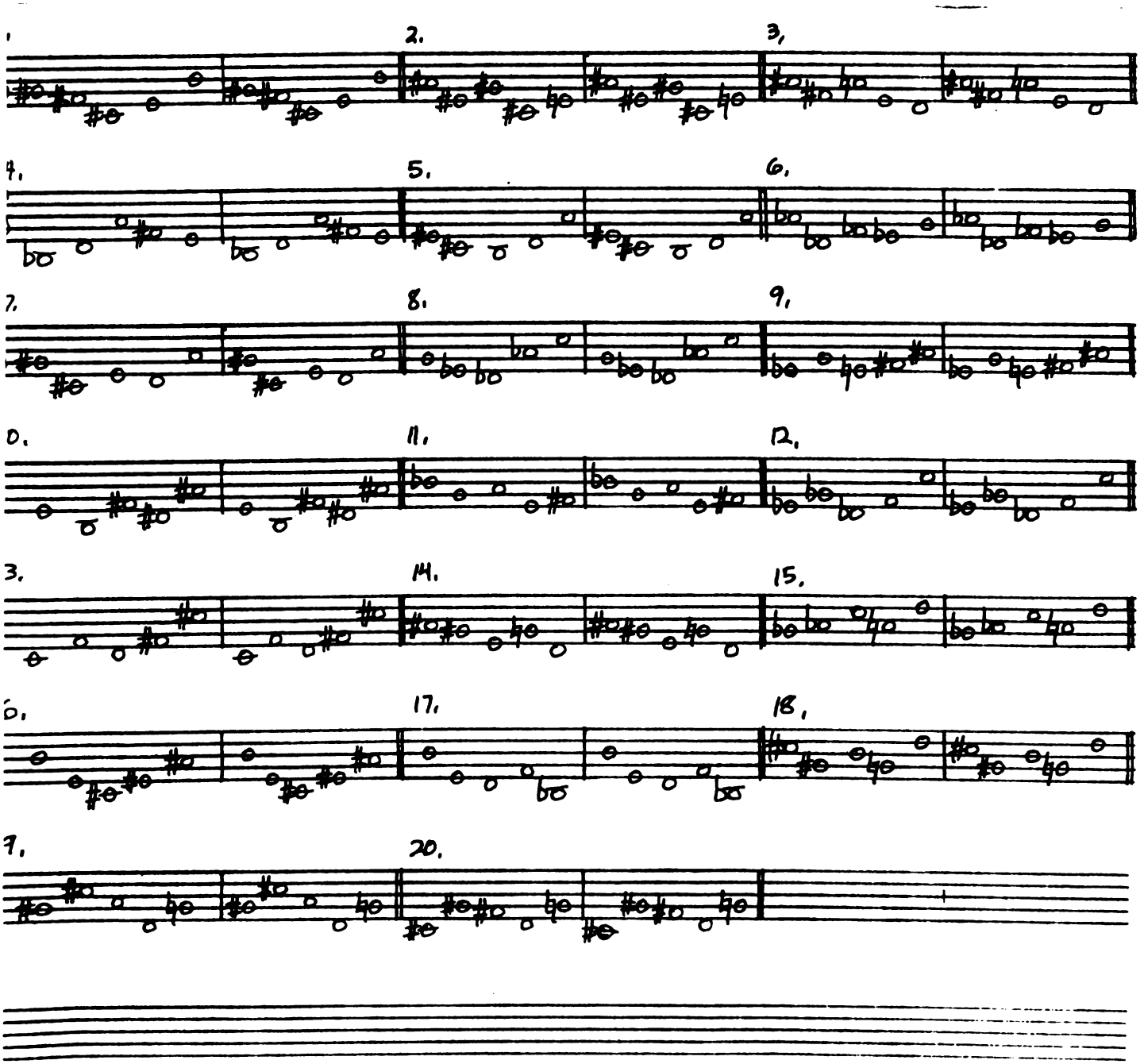
Name Date



ATONAL SIGHT SINGING DRILLS

UNIT XIII

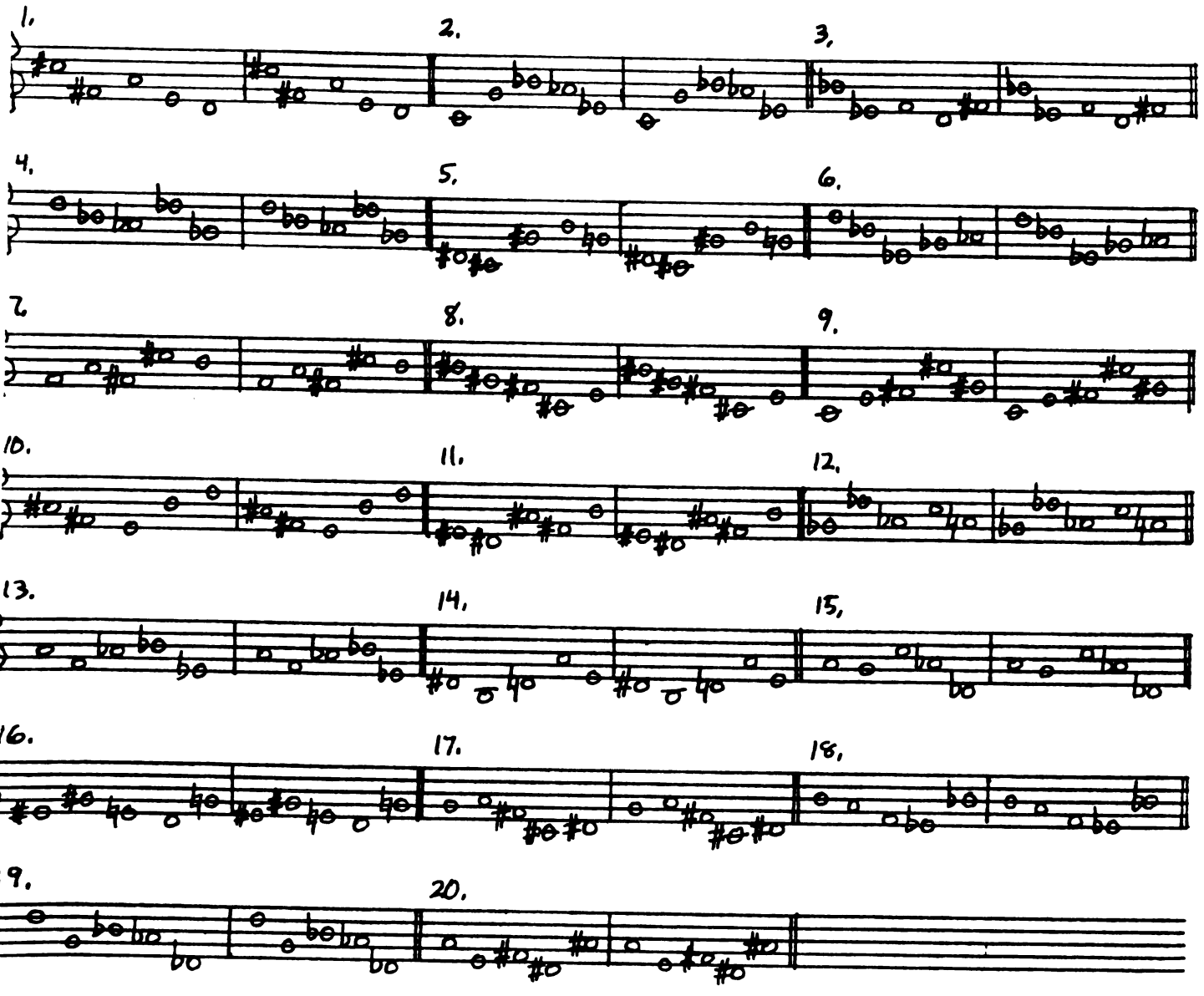
Name Date



ATONAL SIGHT SINGING DRILLS

UNIT XIV

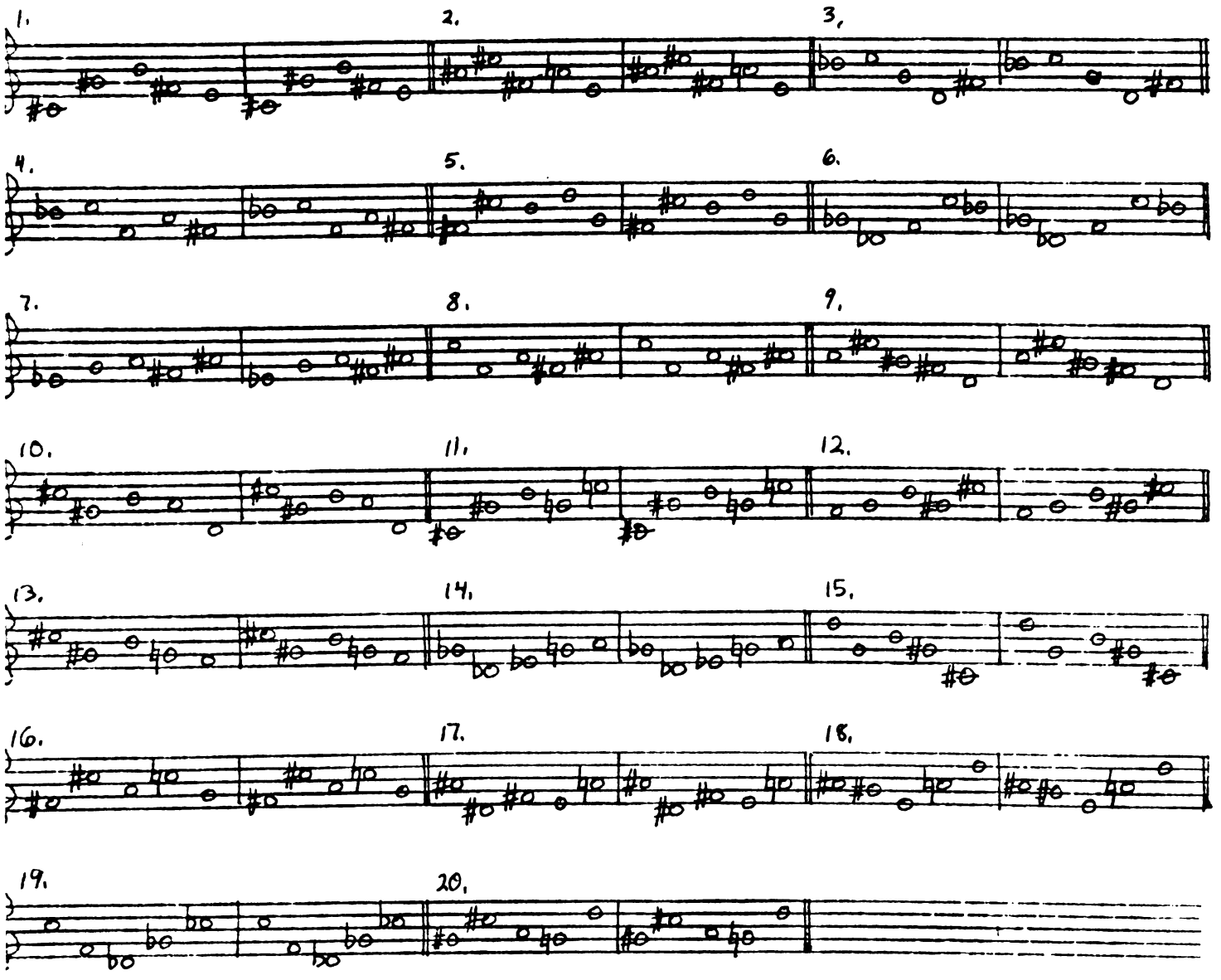
Name Date



ATONAL SIGHT SINGING DRILLS

UNIT XV

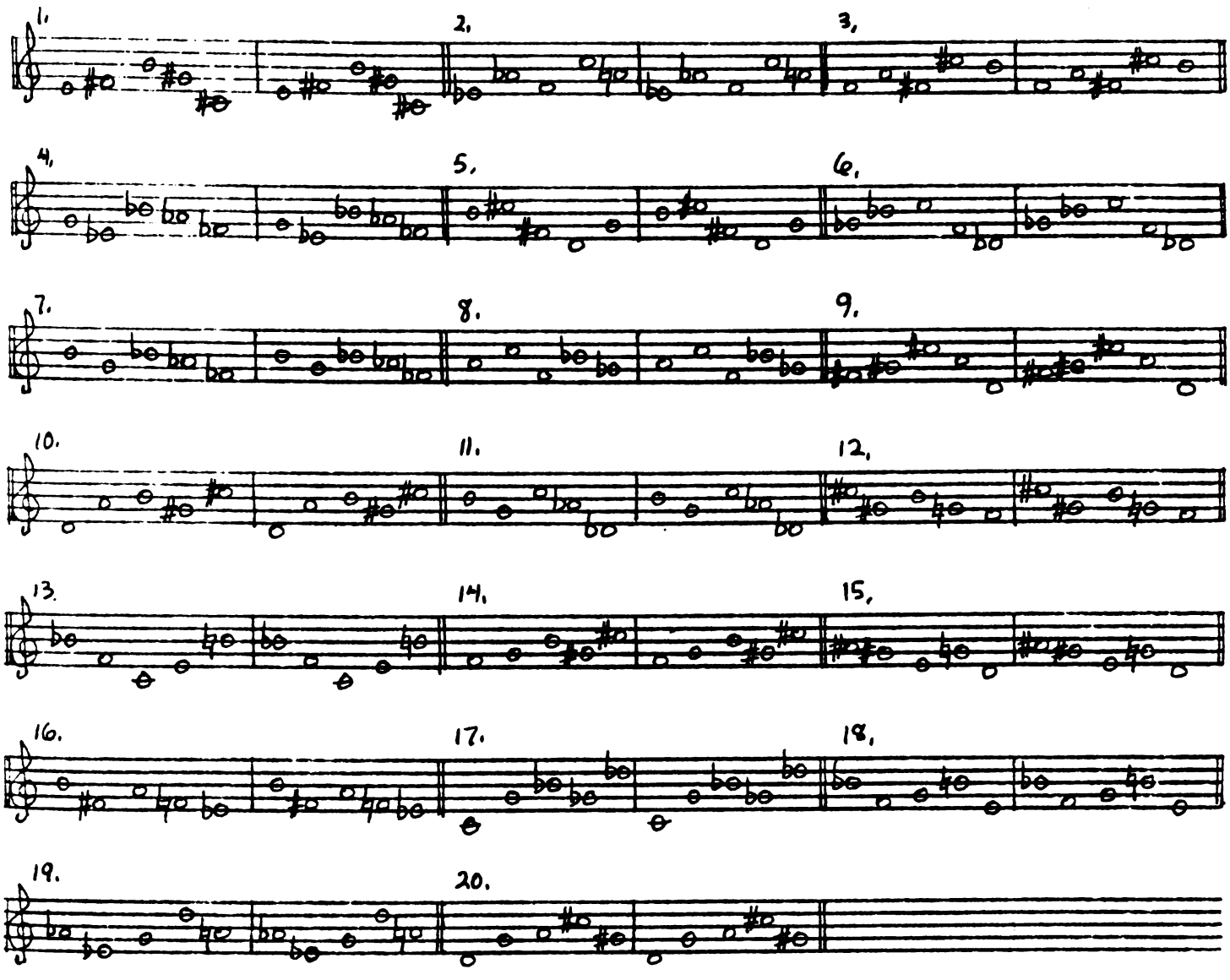
Name Date



ATONAL SIGHT SINGING DRILLS

UNIT XVI

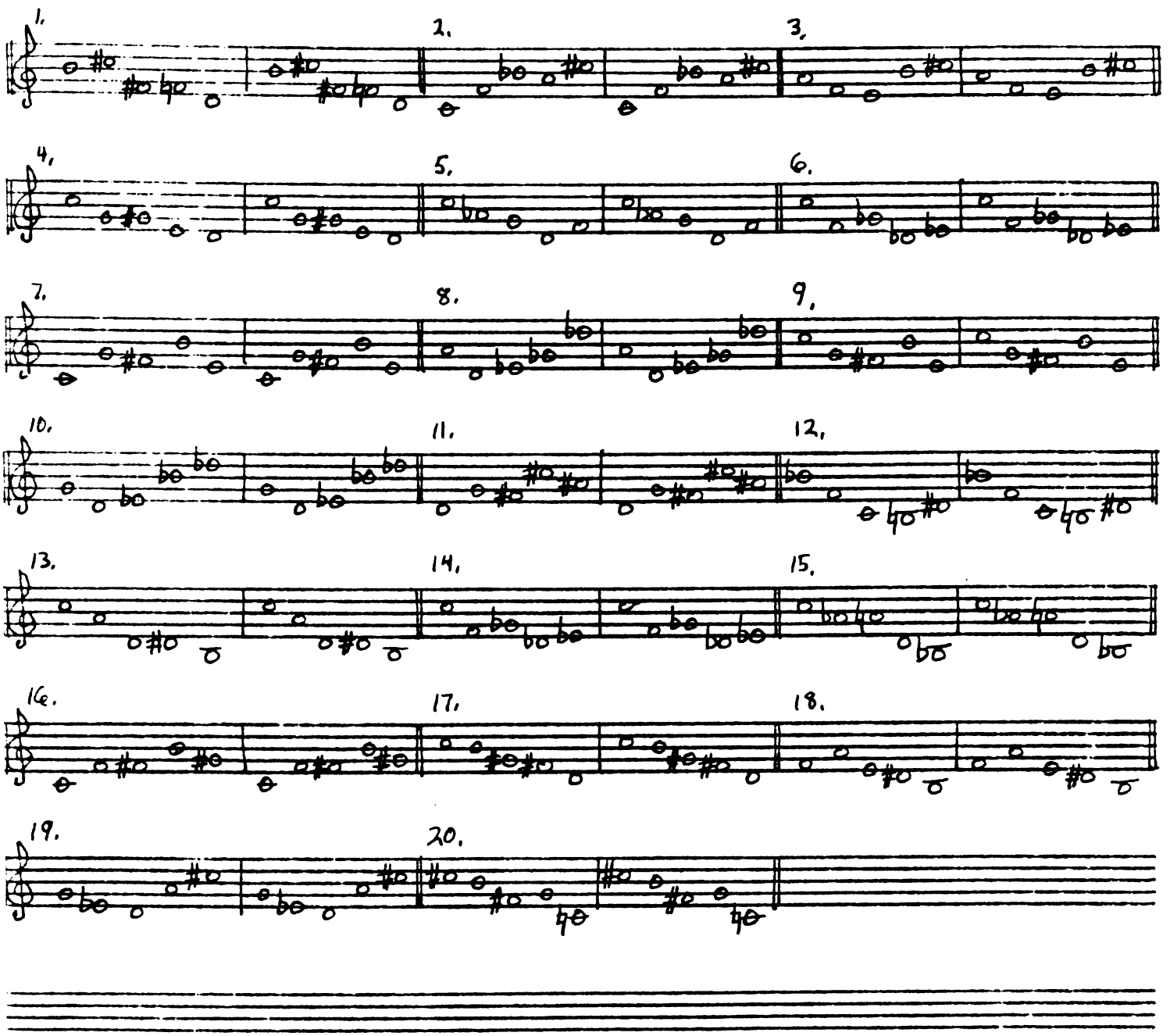
Name Date



ATONAL SIGHT SINGING DRILLS

UNIT XVII

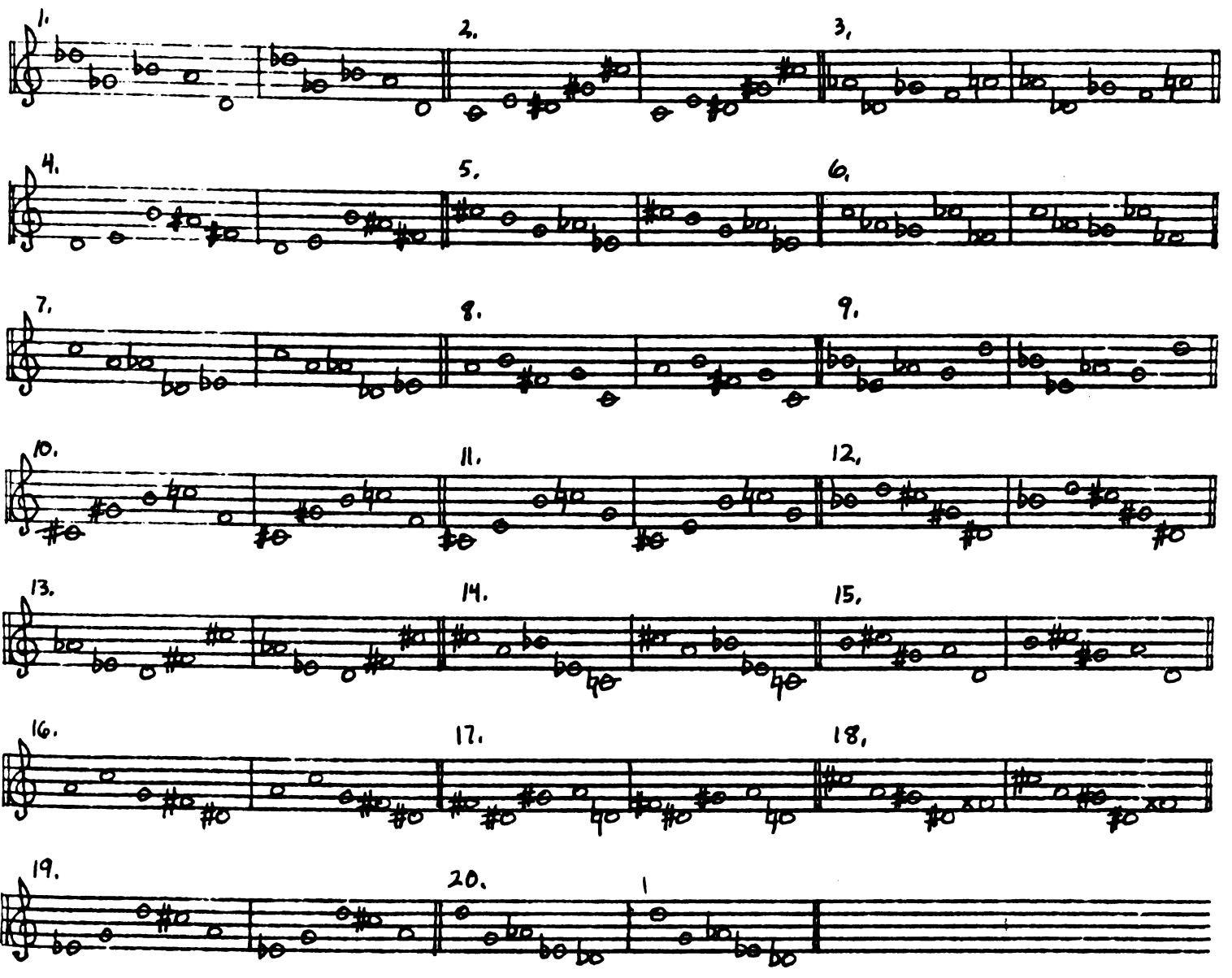
Name Date



ATONAL SIGHT SINGING DRILLS

UNIT XVIII

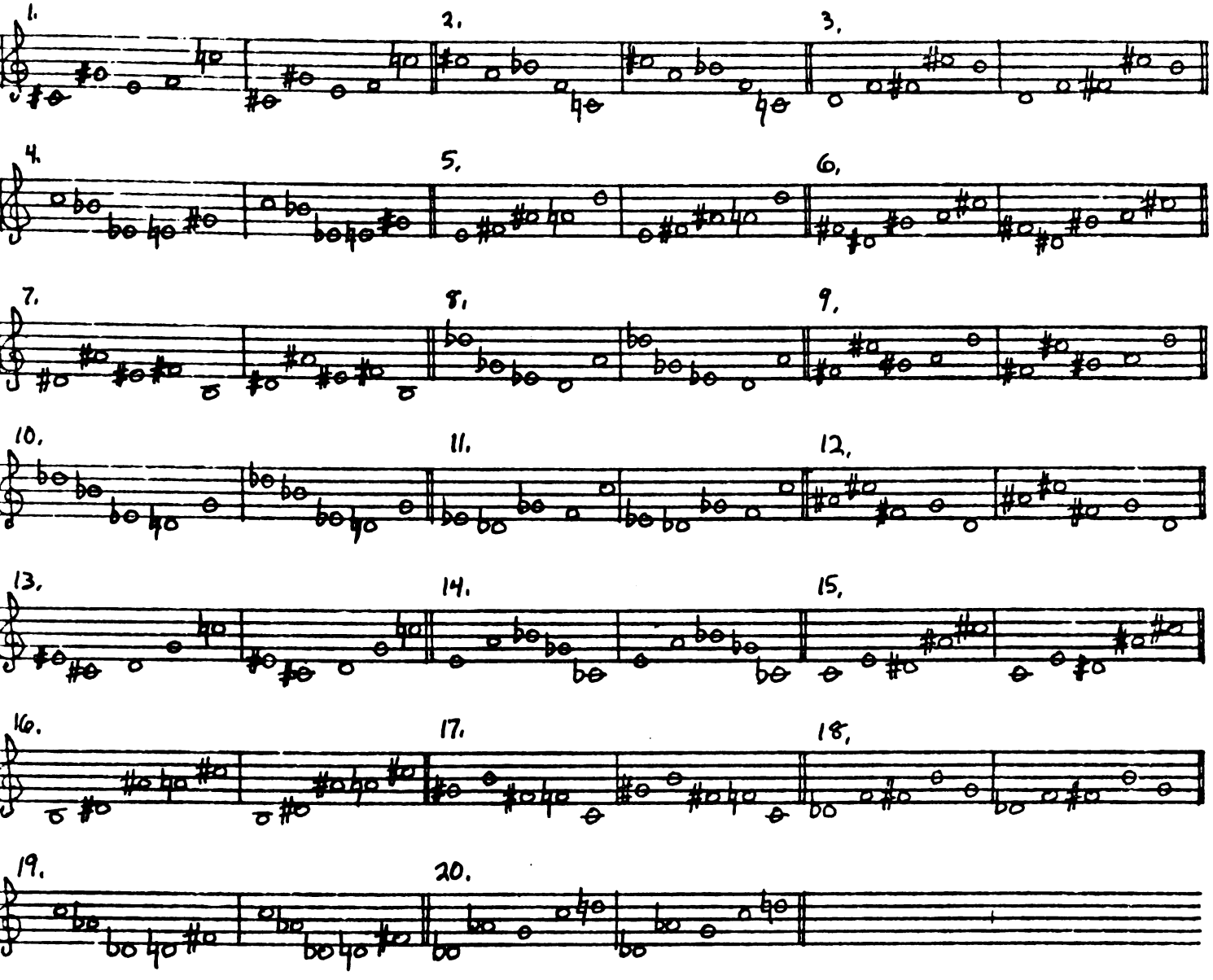
Name Date



ATONAL SIGHT SINGING DRILLS

UNIT XIX

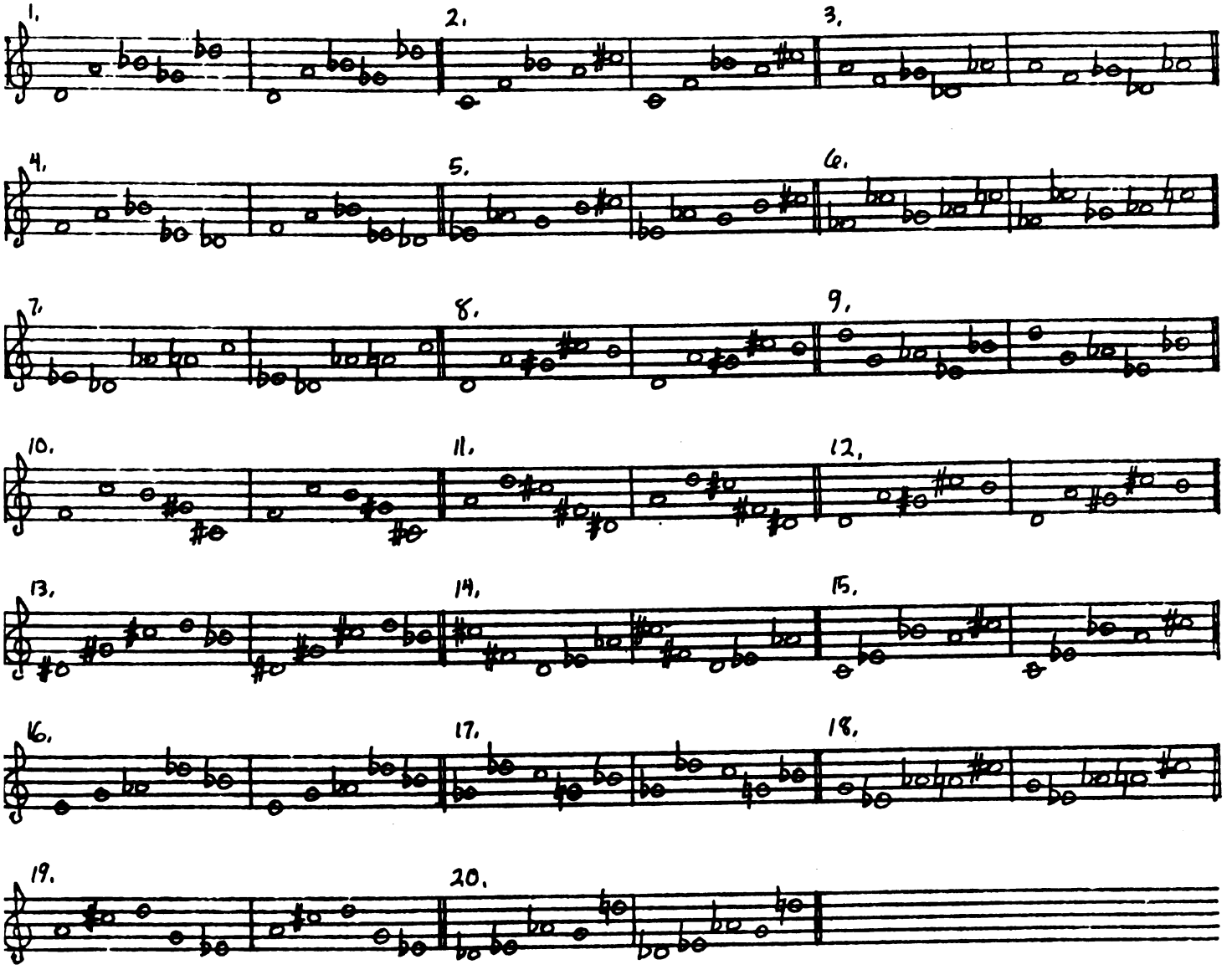
Name Date



ATONAL SIGHT SINGING DRILLS

UNIT XX

Name Date

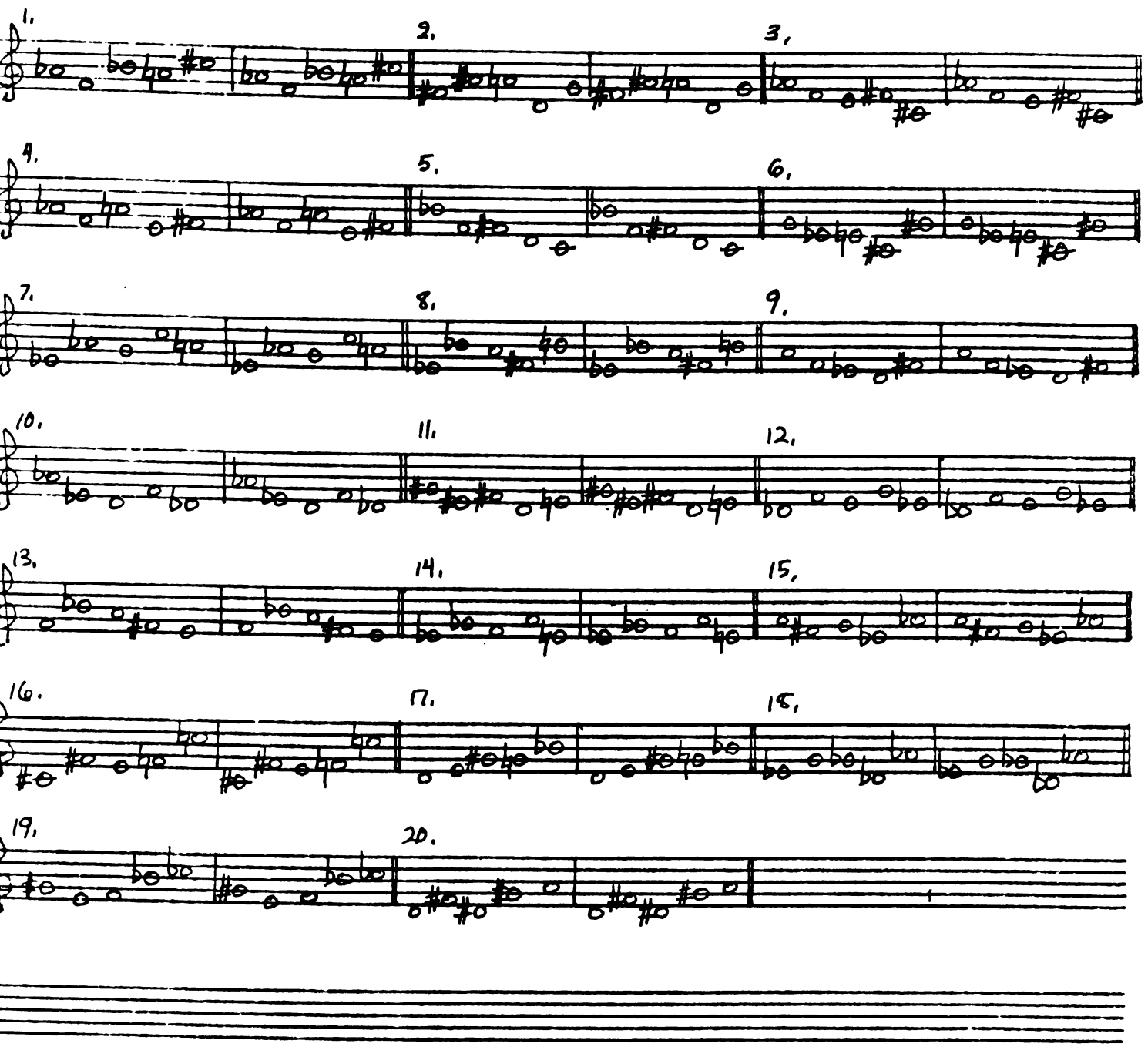


ATONAL SIGHT SINGING DRILLS

UNIT XXI

Name

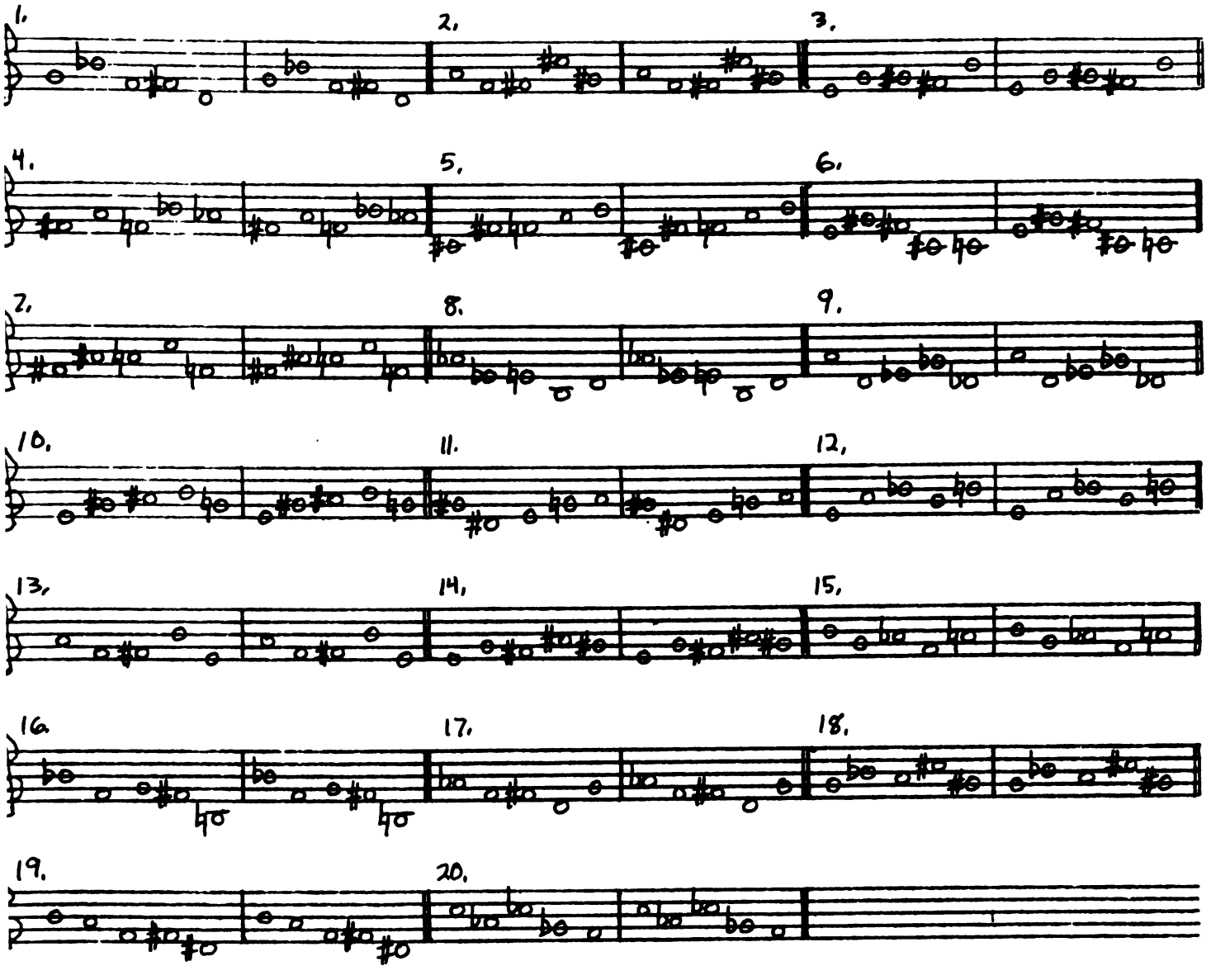
Date



ATONAL SIGHT SINGING DRILLS

UNIT XXII

Name Date



ATONAL SIGHT SINGING DRILLS

UNIT XXIII

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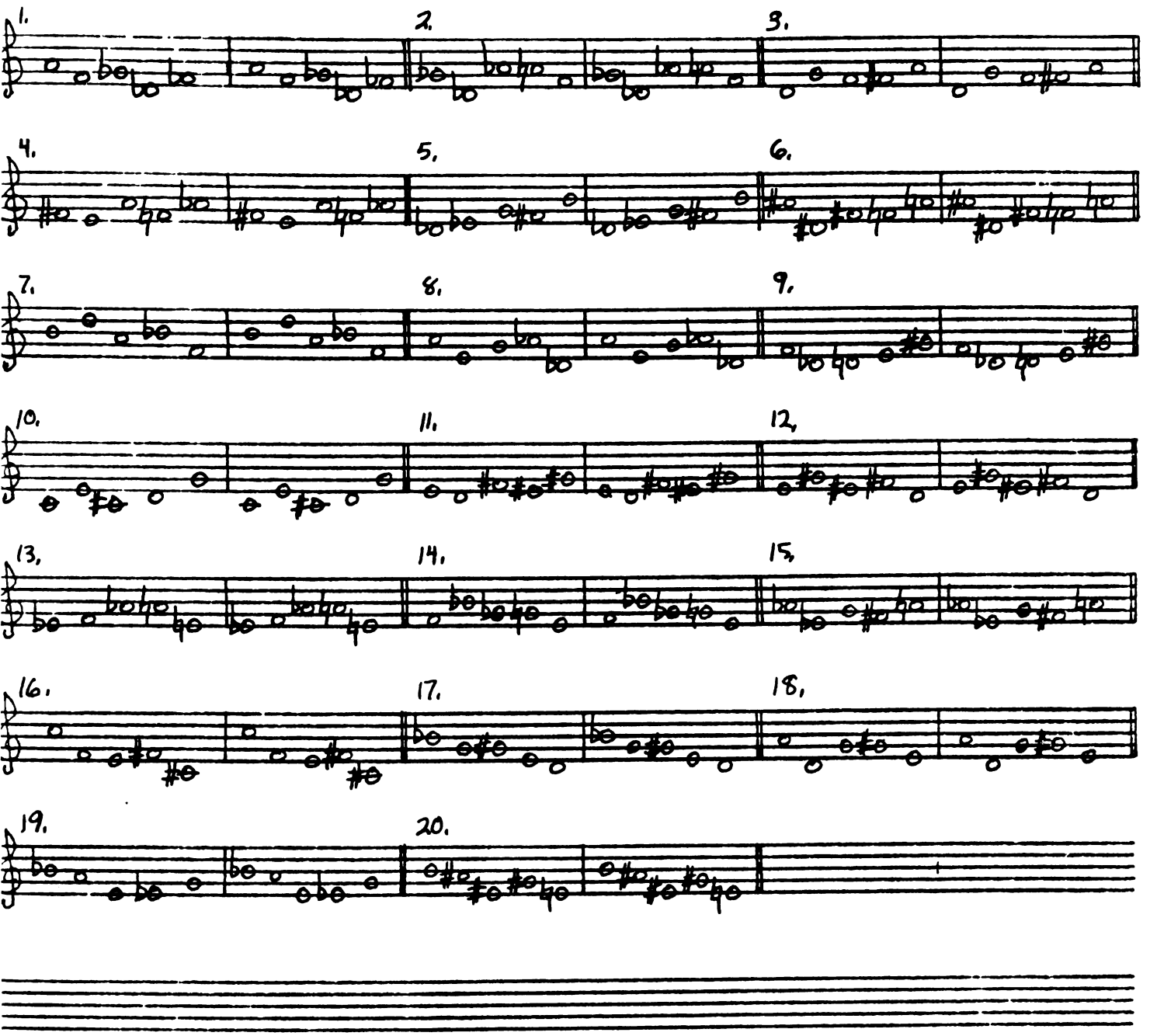

ATONAL SIGHT SINGING DRILLS

UNIT XXIV

Name Date